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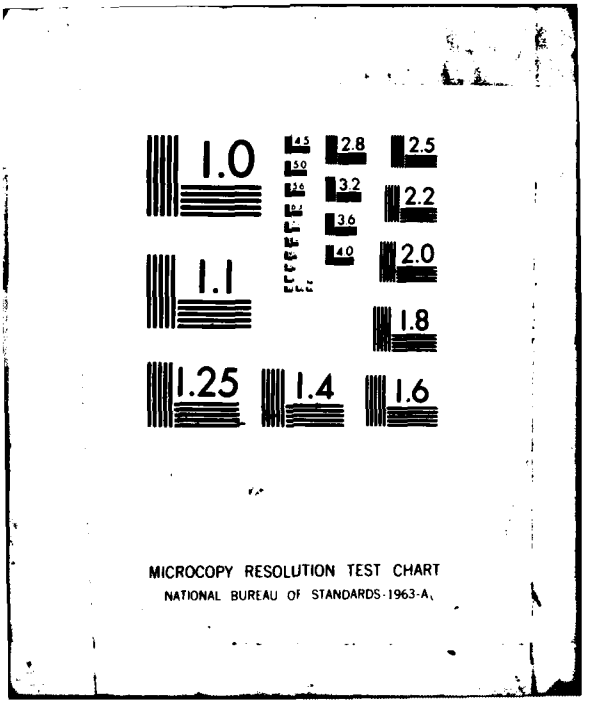
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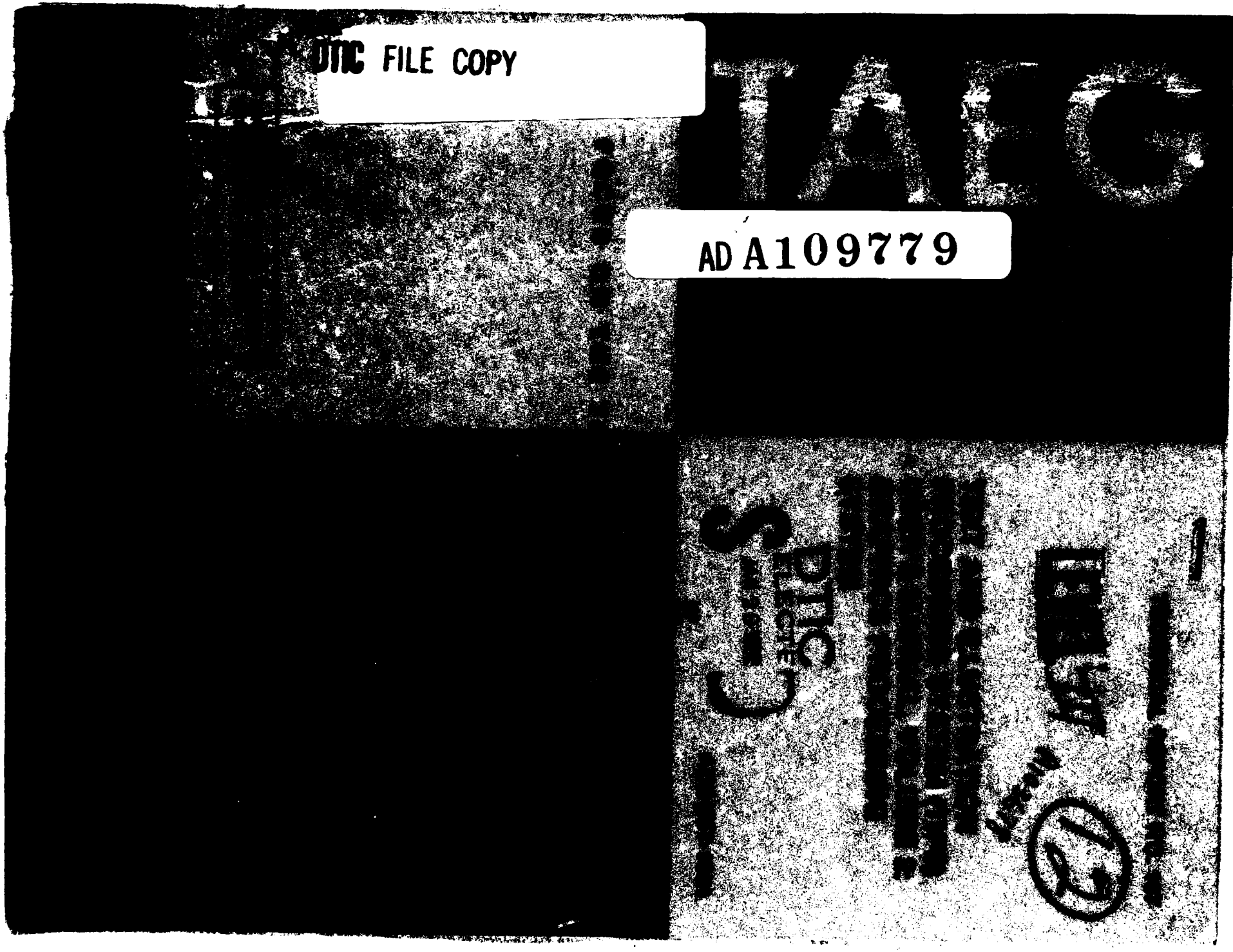


TAEG Report No. 107

TEXT AND ILLUSTRATION PROCESSING SYSTEM (TIPS) USER'S MANUAL

VOLUME 2
Graphics Processing System

Ray Cox
Richard Braby

Training Analysis and Evaluation Group

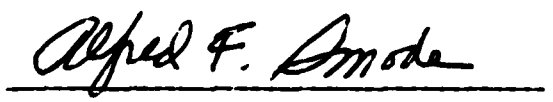
August 1981

Sponsored by

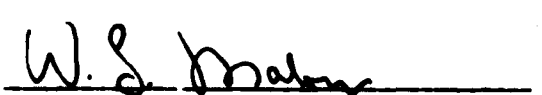
Chief of Naval Education and Training

and the

David W. Taylor Naval Ship Research and Development Center
Naval Technical Information Presentation Program



ALFRED F. SMODE, Ph.D., Director
Training Analysis and Evaluation Group



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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This manual describes a graphics processing system developed by the Training Analysis and Evaluation Group. This volume contains the procedures to teach the relatively inexperienced author how to enter and process graphic information. It describes the illustration processing routines including scanning graphics into computer memory, displaying graphics, enhancing them in various ways, and adding annotations and overlays. It also describes routines for managing both active files and archives. (continued on reverse)

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20. ABSTRACT (continued)

Volume 1, published in July 1981 as TAEG Report No. 106, describes the text processing system.

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SECTION I

INTRODUCTION

Research on designing instructional materials points toward a more extensive use of graphics to enhance the effectiveness of technical training programs. Properly integrated, graphics and text are complementary, each making a special contribution to the messages, exercises, and tests that make up a learning sequence. Unfortunately, the training and experience of many authors have tended to emphasize only the word oriented tools and techniques of the writing profession. In addition, the development of graphic materials has been labor intensive and done primarily by graphics designers with little experience in the nature of human learning. Further, the cost of developing and reproducing graphics in the quantities needed to fully exploit their capabilities has been prohibitive. These factors have constrained the widespread use of graphics in current instructional packages.

Now, however it is technically feasible to combine the generation and formatting of text and graphics in a single word/graphics processor. It is anticipated that this technology will play an important role in the Navy's efforts to bring together a full range of useful computer-based publishing techniques. This is being accomplished in the Naval Technical Information Presentation Program (NTIPP). The goal of this program is to design a highly efficient authoring and publishing system for use in preparing the operator, maintenance, training, and logistic support documents for new Navy equipment.

In support of NTIPP, the Training Analysis and Evaluation Group (TAEG) has been exploring the feasibility of using computer text and graphics routines in authoring instructional materials. The initial concepts for authoring aids were demonstrated by Braby, Parrish, Guitard and Aagard (1978) (1). Computer routines were used to automatically generate training materials containing excercises and tests to teach symbol recognition.

(1) R. Braby, W. F. Parrish, C. R. Guitard, and J. A. Aagard. Computer Aided Authoring of Programmed Instruction for Teaching Symbol Recognition. TAEG Report No. 58, 1978. Training Analysis and Evaluation Group, Orlando, FL 32813 (AD A068041)

Routines to automatically insert of graphic symbols and typesetting commands into the text stream were subsequently developed by Keeler (1980) (2). Additional concepts that will make the system responsive to a broad range of tasks were provided by Braby and Kincaid (1980) (3). All of these elements are being built into an authoring system for use in demonstrating the practicality of the various automated authoring functions.

At present, portions of the system are still under development but with a number of components in place. When the unfinished routines have been included, a condition scheduled to exist in 1982, the system will enable designers to create illustrated instructional material by keying or scanning information into the data base in response to the computer requests for verbal and pictorial information about the equipment being supported. Basic format decisions will be achieved by author-computer interaction. Computer routines will then automatically compose the illustrated document (including the title page, table of contents, presentation of information, exercises, tests and answers to tests) and prepare camera-ready copy. Many of the components of the computer aided authoring system can be used independently of the total system.

A basic component of computer aided authoring, is the Text and Illustration Processing System (TIPS), a system developed by TAEG. TIPS is described in two volumes. The first volume (Brown and Cox, 1981) (4) provides the procedures for text processing. It is a user's manual for teaching the relatively inexperienced user of the system (author or typist) how to enter and edit textual material. The second volume (the present report) is a user's manual for teaching the relatively inexperienced author how to enter and process graphic information. It describes the illustration processing routines including scanning graphics into computer memory, displaying graphics, enhancing them in various ways, and adding annotations and overlays. It also describes routines for managing both active files and archives.

(2) F. L. Keeler. Systems for Computer Automated Typesetting (SCAT) of Computer Authored Texts. TAEG Report No. 88, 1980. Training Analysis and Evaluation Group, Orlando, FL 32813 (AD A088638)

(3) R. Braby and J. P. Kincaid. Computer Aided Authoring and Editing. Technical Note 1-81, 1981. Training Analysis and Evaluation Group, Orlando, FL 32813 (AD A096258)

(4) Cheryl J. Brown and R. Cox. Text and Illustration Processing System (TIPS) User's Manual. Volume 1, Text Processing System. TAEG Report No. 106, 1981. Training Analysis and Evaluation Group, Orlando, FL 32813 (AD A103678)

In addition to separately processing text and graphics, TIPS routines can be used to merge text and digitized photographs or line drawings into a composite page for display on a graphic display device. At the present time this capability is limited to a specific display installed at TAEG.

In the graphics processing system, the hardware additions needed to process graphics are low cost components added to a WANG 2200 VP mini computer. The software is in WANG BASIC II, the language used for the TIPS text processor routines. Neither this hardware nor the programming language is optional for graphics processing. As a result, graphic processing in this system is slow with individual routines requiring as long as 4 minutes. Faster processors would perform these tasks in seconds. Despite the fact that the TIPS graphics processor is not production volume oriented, it provides an inexpensive means of determining the types of graphic functions that are useful as extensions of a text processing system to create illustrated instructional material.

Two basic capabilities are still lacking in the TIPS graphics processing system. First, work has not been completed on interfacing the TIPS text and graphic processors to a typesetter, an essential step if graphics are to be printed on paper. This component is nearing completion. And, second, an advanced vectorgraphic system is needed to allow an author to sketch on a tablet to enter illustrations directly into computer memory. This component will be added as resources become available.

ORGANIZATION OF THE REPORT

In addition to this introduction, the report contains eight sections and seven appendices. Sections II through IX contain the body of the User's Manual and appendices A through G contain descriptions of equipment used, samples of graphics made with the various routines, and explanations of specific functions.

Sections II through IX are arranged in a sequence which corresponds closely to the order in which they would be used. Section II informs the user about the system hardware and explains generally how to use the system. In section III the user learns how to scan a graphic and store it in computer memory. Section IV gives directions for displaying a graphic file; section V discusses special image enhancement functions; section VI explains how to annotate a graphic; and section VII shows how to create an overlay. In section VIII the user learns how to analyze a graphic file for enhancement, and section IX describes the archive storage capability of the system.

Appendix A describes each piece of equipment used in the graphics part of the system, including the equipment name, manufacturer, and characteristics. (The basic WANG equipment, which is also used in text processing, is described in TIPS, Vol. I, Text Processing System, (Brown and Cox, 1981) (5). Appendix B describes a file naming convention used in storing and retrieving graphics, and in identifying the resolution of the graphic, and which enhancement or other image modifying routines have been performed. Appendix C contains examples of line drawings scanned normally and also sliced to force each pixel to be either black or white. Appendix D describes the program architecture of a graphic data file, a topic of interest to programmers. Appendix E presents before and after examples of images that have undergone various types of image enhancement, including 25 percent reduction, 25 percent enlargement, shifting the midpoint of the gray scale, edge enhancements, posterization, and solarization. Appendix F contains a technical description of the FGP memory gating technique in the graphics system and will be of interest to digital system designers. Appendix G presents an explanation and example of the overlay and annotations functions of the system used in composing pages of text and illustration.

(5) Ibid.

SECTION II

USING THE SYSTEM

OVERVIEW

Preparing a photograph or line drawing to be displayed digitally along with text is a three-step process. First, the illustration must be digitized and stored on disk. Second, the digitized illustration may be enhanced or modified in a number of ways, depending on original quality and desired result. Finally, the photo command (PH) must be inserted at the appropriate point in the text file.

DIGITIZING A GRAPHIC. Digitizing a graphic requires first that the graphic be converted to a video image. This analog data is then converted to a digital format, and the digital representation of the graphic stored on disk.

Graphics to be used only once can be digitized at their final output size. Graphics to be used in more than one size can be digitized at the most convenient size and then later modified to required sizes by the computer.

ENHANCING A GRAPHIC. Once digitized, the TIPS GRAPHIC PROCESSOR can perform a number of different enhancement operations on a graphic. For instance, all graphics to be displayed by TIPS must be reduced from the original 256 gray scales to 16 gray scales. This reduction may be done before or after other enhancements.

The output size of a graphic is usually of some concern. The graphic processor permits digitized graphics to be trimmed, enlarged, or reduced in overall size.

The appearance of an original graphic may be altered using the graphic enhancement program. This program will adjust the gray scale values of any selected range. It allows the user the maximum flexibility in selecting the range, or ranges, of gray levels to be acted upon, the midpoint of any range, and the form of the curve to be used in reassigning gray level values.

DISPLAYING A GRAPHIC. The photo command (PH) in the TIPS Text Processing System is used to merge graphics and text onto a single display. To set the command properly, the user must determine the location of the graphic on the page and the actual size of the graphic as it is stored on disk. As a minimum, the graphic must fit within the allocated page size, exclusive of margins, and the graphic must have been scaled to the requirements of the output device. By properly selecting coordinates, several graphics may be displayed

simultaneously. Text annotations may be superimposed on an illustration, and overlays such as arrows and circles can be placed over an illustration or block of text.

EQUIPMENT

The TIPS graphic processing system is designed to operate on a WANG 2200 VP or MVP computer. In addition to the standard peripheral devices, the graphics processing system also requires a video camera, an analog-to-digital converter, a graphics display system and a WANG 2260 or 2280 disk storage device. TAEG currently uses a Hamamatsu C-1000 camera with an M1004 video A/D converter for input and a Genisco 3000 Programmable Graphic Processor with a CONRAC display unit for output. The integration of this equipment is shown in figure 2.1 and described in detail in appendix A.

To effectively use the TIPS graphic processing system you should be familiar with key system hardware. Brief descriptions of these components are contained in the following paragraphs.

KEYBOARD. The WANG keyboard works much like an ordinary typewriter. To type in all caps move the switch in the upper left hand corner to A/A; to type in capital and small letters, set switch to A/a. For 2200VP systems, this switch should be kept in the A/a position whenever using TIPS. The SHIFT key enters Function Keys 16-31, the upper character of number keys, and upper case letters. An important aspect of the keyboard is the presence of special function keys at the top of the keyboard. The keys are numbered from 0-31. Their functions are described in section III of Volume 1 of this User's Manual.

DISPLAY SCREEN. The display screen above the keyboard is called a Cathode Ray Tube (CRT). It displays information as you key it in. A CURSOR is an underscore character on the screen which lets you know where the next character you type will appear.

STORAGE. Files are stored magnetically on either disks or diskettes. A HARD DISK is a large piece of equipment which stores a very large amount of information. A DISKETTE is a small flexible disk in a square envelope.

OUTPUT DEVICE. You may obtain a print-out of your file on a line printer (WANG 2261), a daisy wheel printer (WANG 2281), typewriter, or other similar devices.

CAMERA. A small video camera, mounted over a lighted viewing area, converts graphics into video images which in turn are converted to digital format by an analog to digital converter and finally stored on disk. Refer to figure 2-2.

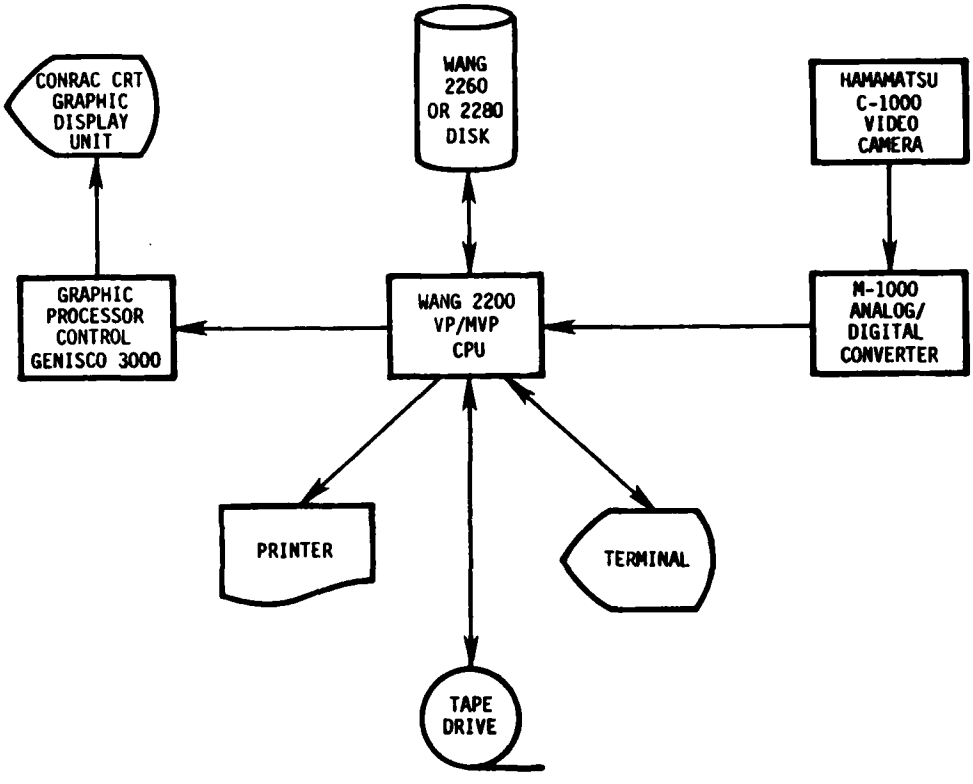


Figure 2-1 Graphic Processing System

GRAPHICS DISPLAY UNIT. A high resolution CRT device is used which can display a black and white image up to a full page in size. It will display both graphic and textual data. Refer to figure 2-3.

PROGRAMMABLE GRAPHIC PROCESSOR (PGP). A small microprocessor is used which controls the data sent to the graphic display unit. Digitized graphic data and instructions are sent from the WANG computer to the PGP which in turn structures the data for display on the graphics display unit CRT screen. Refer to figure 2-3.

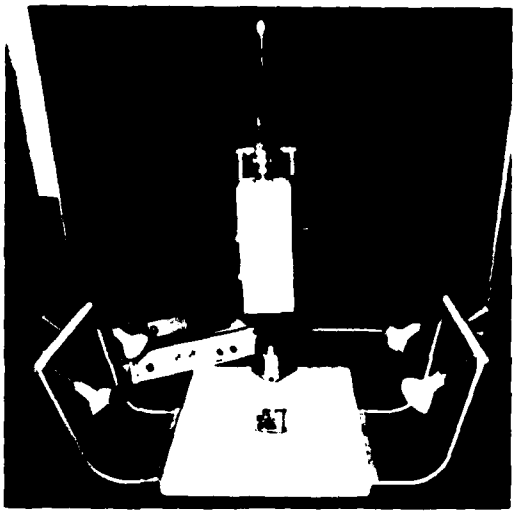


Figure 2-2. Video Camera and Monitor with Camera Interface

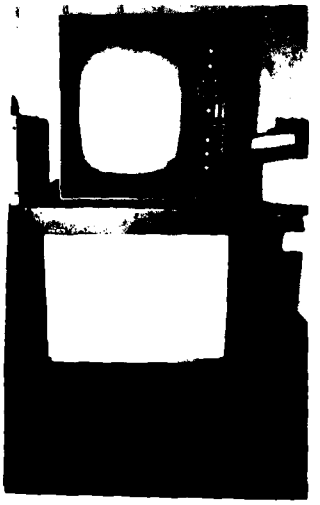


Figure 2-3. Genisco 3000 and CONRAC Unit

START-UP PROCEDURES

Start up procedures vary with each installation but in most cases to start up the system you must select the disk which contains the TIPS graphics system programs. TIPS may be stored in the computer on a hard disk or diskette. If TIPS is on a diskette, you should insert the diskette.

To use the system:

TYPE: CLEAR
PRESS: RETURN

TYPE: SELECT DISK and the address of the system platter. You can get the address number from the system manager. Then,
PRESS: RETURN

TYPE: LOAD RUN
PRESS: RETURN

On some systems you may have to select the word processing system option; otherwise, the TIPS Main Menu, shown in figure 2.4, will appear and you may choose the function desired.

WORD PROCESSING SYSTEM

MAIN MENU

SELECT FUNCTIONAL AREA BY PRESSING NUMBER KEY

0. Quit
1. Create a New File
2. Edit an Existing File
3. Print Single File
4. Utilities
5. Build/Maintain Index
6. Print Using Index
7. Backup/Restore Files
8. Graphics Processing System

Figure 2-4. TIPS Main Menu

Volume 1 of TIPS contained instructions on options 1 through 7 of the TIPS Main Menu. This volume will deal only with option 8, the Graphics Processing System. To load the Graphics Processing System, press 8.

The Main Menu of the Graphics Processing System, shown in figure 2-5, will now appear on the CRT screen. You may now choose the graphic function you desire. To select a function, press the letter key corresponding to that function. Each function is described in detail in subsequent chapters.

GRAPHICS PROCESSING SYSTEM

MAIN MENU

SELECT FUNCTION BY PRESSING LETTER KEY

A - SCANNING A GRAPHIC
B - DISPLAYING A GRAPHIC
C - ENHANCING A GRAPHIC
D - ANNOTATING A DISPLAY
E - CREATING OVERLAYS
F - ANALYZING GRAPHIC FILES
G - ARCHIVE PROCESSING

Figure 2-5. Graphics Main Menu

SECTION III

SCANNING A GRAPHIC

INTRODUCTION

Scanning is the process of converting a graphic into digital data which can be stored on disk. The camera scans the photograph, line drawing, or other graphic and converts the image to many small picture elements (pixels). The camera scans the graphic from top to bottom and from left to right. Each top-to-bottom slice of the graphic is one raster. The number of pixels per raster and the number of rasters per graphic determine the resolution of the scanned, or digitized, data.

The camera views a square area so that there are usually the same number of pixels per raster as there are rasters. The camera can convert a graphic into a maximum of 1024 rasters with 1024 pixels per raster. Often, however, a coarser resolution is acceptable and resolutions of 512 or 256 could be used.

Each pixel transmitted by the camera represents one of the 256 possible shades of gray from pure black (a value of 0) to pure white (a value of 255). A pixel requires 8 bits of storage. At 256 resolution, one raster requires 1 disk sector of storage space; two sectors at 512 resolution; and 4 sectors at 1024. Maximum file size is 259 sectors at 256 resolution; 1027 sectors at 512 resolution; and 4099 sectors at 1024 resolution. (Three sectors are required per file for system overhead.)

Slicing is the process of converting each point in a graphic image to either black or white data. In this process, all shades of gray are pushed either to the black and white end of the gray scale. It is usually applied to black and white line art. Since the camera in use at TAEG can not automatically generate sliced data, this process is accomplished by the system software. This approach has not proven totally satisfactory, but is usable as an interim measure. When used with data compaction, slicing can significantly reduce storage requirements for digitized line art. To load the scanning subsystem, select option A on the Graphics Main Menu, shown in figure 2-5.

The Scan Menu, shown in figure 3-1, will now be displayed. This menu provides options to scan a graphic, slice a graphic, scan a graphic to a predetermined size, or position the camera marker.

* * * SCAN MENU * * *

SELECT OPTION BY PRESSING LETTER KEY

A - POSITION MARKER
B - SCAN GRAPHIC
C - SLICE GRAPHIC
D - SCAN GRAPHIC TO SIZE
E - DISPLAY MENU
F - ENHANCE MENU

Z - ** Return to Main Menu **

Figure 3-1. Scan Menu

POSITION MARKER

This option allows you to select a starting point for the scan or slice operation other than the extreme left edge of the scanning area.

NOTE: In discussing scan and slice operations, all directional references will apply to the image as it appears on the camera monitor screen. Due to the optical properties of the lens, the graphic must be placed under the camera upside down. It is important that the graphic appear correctly, i.e., right side up, on the camera monitor so that it will agree with the discussion presented in this manual.

The camera video monitor displays the area being scanned by the camera. It can also show the marker and the intensity graph. The marker shows the raster currently being scanned. The intensity graph reflects the intensity (darkness) of the area of the photo directly under the marker. The darker the image the farther the intensity graph will move to the left. At rest the marker is at position 512 and the intensity graph will be displayed.

To position the marker, select option A on the Scan Menu. The program will then ask:

SELECT X-COORD POSITION (0-1023) ?

TYPE the desired position of the marker, and

PRESS: RETURN

The marker will then be moved to that position on the monitor screen and the intensity graph will be turned off. The program will then ask:

DO YOU WANT TO TRY AGAIN (Y OR N) ?

If the marker is now positioned where you want, note the position, and

PRESS: N to terminate the program and return to the Scan Menu.

If you want to try another position,

PRESS: Y to restart the program.

When the program terminates, the camera will return to its rest position and the Scan Menu will be displayed.

SCAN/SLICE A GRAPHIC

The operation of the scanning and slicing functions is the same. The data stored on disk after the operation will be different. The scan operation stores data representing that portion of a range of 256 gray shades which were reflected in the graphic. The slice operation converts each gray shade into either black or white before the data is stored on disk.

To scan a graphic, select option B on the Scan Menu; To slice a graphic, select option C on the Scan Menu.

The program will then ask:

SELECT DISK DEVICE * ---

The default or last used disk address will be displayed. If the address is where you wish to store the digitized graphic data,

PRESS: RETURN

Otherwise,

TYPE the disk address at which you wish to store the graphic data, and

PRESS: RETURN

To return to the Scan Menu,

PRESS: ERASE

PRESS: RETURN

Next, the program will ask for the desired horizontal and

vertical scales:

SELECT HORIZONTAL SCALE ?

1 - 256

2 - 512

4 - 1024

PRESS the number key corresponding to the resolution you desire. This value will determine the maximum number of rasters in your file. The actual number will depend on the initial position of the marker and may be determined by the following formula:

$$\frac{(1024 - P)R}{1024}$$

where: P = the initial position of the marker

R = the horizontal resolution

SELECT VERTICAL SCALE ?

1 - 128

2 - 256

3 - 512

4 - 1024

Normally this value will be the same as the horizontal scale. You may, however, select a vertical scale which is 1/2 of the horizontal scale. In such cases only the upper half of the image displayed on the camera monitor will be stored on disk. To select a vertical scale,

PRESS: the number key corresponding to your choice.

Next, the program will ask for the initial position of the marker:

SELECT X-COORD POSITION (0-1023) ?

TYPE the desired marker starting position, and

PRESS: RETURN

A value of zero (0) yields a scan of the entire area under the camera. A value of 1023 results in a scan of only 1 raster from the extreme right edge of the area. A proper interim value can be determined using the POSITION MARKER option on the Scan Menu.

Next, the program will ask what name you wish to assign to the digitized graphic file:

SELECT FILE ID (4 CHARACTERS) ?

TYPE a unique 4-character name for the graphic file, and

PRESS: RETURN

The program will append one of the following values to your file ID to complete the WANG 8-character disk file ID. (See appendix B for a discussion of file naming conventions.)

Horizontal Resolution	Appendage
256	.256
512	.512
1024	.024

Next, the program will ask if you want the marker to remain on during scanning:

MARKER ON (Y OR N) ?

To leave the marker on,

PRESS: Y

To turn the marker off,

PRESS: N

The next query will depend on whether you are scanning or slicing a graphic. If you are scanning a graphic, the program will ask:

DISPLAY INTENSITY GRAPH (Y OR N) ?

To display the intensity graph during scanning,

PRESS: Y

To turn off the intensity graph during scanning,

PRESS: N

The slicing program will ask instead:

SELECT PIXEL SEPARATION (40-100) ?

NOTE: Experience has shown that there are often major differences in quality of scanned line art. The best values fo slicing line art are frequently determined by trial and error. (Some examples are shown in appendix C.) The slicing program determines which pixels in a raster are black and which are white. This process starts when the program identifies the value of the lightest pixel. Then it subtracts from this value the

pixel separation value. All pixels in the raster that have values in this zone are made white. Those below this value are made black. In general, higher separation values can be used with line drawings of high contrast and little clutter. Lower numbers are for drawings with less contrast and more clutter.

TYPE the desired pixel separation value, and

PRESS: RETURN

The program will now scan or slice the graphic and build a disk of digitized data. When the scanning/slicing process is complete, the program will display the name assigned to the file and will return to the Scan Menu.

ERRORS. The following messages may appear on the screen while scanning/slicing a graphic:

DATA FILE EXISTS - SCRATCH (Y OR N) ?

The file name you have chosen for your graphic file (4-character ID plus appendage) already exists on the specified disk unit. To scratch the file (write over the existing data, destroying it),

PRESS: Y

To select another file instead,

PRESS: N

If you opt to scratch a file (i.e., schedule a file to be written over), the program will check the size of the file to ensure that it is large enough to contain the next graphic being scanned/sliced. If it is large enough, it will be used. If it is not large enough, or any other error is detected, you will be asked to select another file.

SCAN GRAPHIC TO SIZE

Frequently you will know in advance how big you want the displayed image to be. In such cases, this program allows you to specify the final size of the graphic image before it is scanned.

NOTE: At this time the scan to size algorithms are based on the size of the graphic as displayed on the CONRAC CRT screen. They are not geared to the requirements of a typesetter or any other output media.

To scan a graphic to size, select option D on the Scan Menu. The program will first request the desired horizontal size of the output graphic image in inches:

TYPE HORIZONTAL SIZE OF OUTPUT PHOTO IN INCHES

TYPE the desired width of the output photo, and

PRESS: RETURN

The requested size must be reasonable. The maximum size of the emulated page is 8 1/2 by 11 inches. Parts of an inch may be specified as a decimal fraction. For example:

6 1/2 inches = 6.5

5 1/8 inches = 5.125

3 1/4 inches = 3.25

To terminate the program and return to the Scan Menu,

TYPE: 0, and

PRESS: RETURN

If the program is not terminated the program will now request the desired vertical size of the output graphic image in inches.

TYPE VERTICAL SIZE OF OUTPUT PHOTO IN INCHES

TYPE the desired vertical size of the output photo, and

PRESS: RETURN

For best results, the horizontal and vertical dimensions of the output photo should correspond roughly to the dimensions of that point of the graphic being scanned. The measurements do not have to match, but they should be proportional.

To restart the program,

TYPE: 0, and

PRESS: RETURN

Next, the program will ask for the desired resolution:

TYPE INPUT RESOLUTION

(256, 512, OR 1024)

TYPE the desired resolution, and

PRESS: RETURN

Both the horizontal and vertical resolution will be the same. The program will compute the necessary parameters for scanning the graphic. If there is a conflict between the requested size and resolution, the program will advise you of the problem and return to the resolution query:

RESOLUTION TOO SMALL FOR SIZE SPECIFIED

Either select another resolution or change the output size limits and try again.

Next, the program will ask for the name of the output file:

TYPE NAME FOR OUTPUT FILE (4 CHARACTERS)

TYPE a unique four-character name for your file, and

PRESS: RETURN

The program will append a 4-character resolution onto your file name to form the 8-character WANG disk file ID as discussed above.

Next, the program will ask:

TYPE DISK ADDRESS FOR --------

TYPE the address of the disk device on which you want your file stored, and

PRESS: RETURN

When all values have been accepted, the program will display the following message on the WANG CRT:

PLACE GRAPHIC UNDER CAMERA SO THAT THE

PORTION TO BE SCANNED IS BETWEEN THE MARKER AND

RIGHT EDGE OF SCREEN AND FLUSH TO THE TOP EDGE

OF THE DISPLAY AREA.

PRESS ANY KEY WHEN READY

The marker will have been positioned at the extreme left edge of the scanning area. Use the camera monitor to position the graphic under the camera. The space from the marker to the right edge of the viewing area will be scanned. The amount of space to be scanned from the top of the display down is variable and will depend on the requested output size. It will be proportional to the horizontal space, but must be visually judged as there are no markers to indicate the limit of the vertical area being scanned.

Experience has shown that common sense parameters will yield reasonable results. Some practice and experimentation will prove helpful in judging the actual area under the camera which is being scanned. A grid or template can be designed for common sizes.

When the graphic has been scanned, the program will display the name of the output file and will return to the Scan Menu.

ERRORS. The following error messages may appear while scanning a graphic to size:

FILE ALREADY EXISTS ON ---

DO YOU WANT TO SCRATCH (Y OR N) ?

The file name you have chosen (4-character ID plus 4-character appendage) already exists on the indicated disk unit. To scratch the file (write over the contents, destroying them),

PRESS: Y

To select another file name or disk address,

PRESS: N

FILE IS TOO SMALL

You have elected to scratch a file, but the file is not large enough to contain the output graphic data. The program will ask you to select another file name or disk address.

DISPLAY MENU

If you wish to display a graphic as initially scanned, you may go directly to the Display Menu by selecting option E on the Scan Menu. This option is fully described in section IV.

ENHANCEMENT MENU

If you wish to enhance a graphic before you display it, you may go directly to the Enhancement Menu by selecting option F on the Scan Menu. This option is fully described in section V.

SECTION IV

DISPLAYING A GRAPHIC

INTRODUCTION

All display functions relate to the PGP and CONRAC CRT. The CRT screen has a 640 by 512 pixel matrix. The CRT has been positioned with the long axis of the CRT vertical to give the semblance of a document page. All programs referring to a CRT screen position reference a point on the 640 by 512 grid. Unless otherwise specified, all references are to the upper left corner of the graphic.

The CONRAC CRT screen can display an entire graphic scanned at 512 resolution or less. Only a portion of a graphic scanned at 1024 can be displayed without reducing the graphic in size or trimming its edges. If a graphic is to be displayed on the CONRAC unit, it should be scanned at the appropriate resolution.

The Display System is loaded when you select option B on the Main Menu. The Display Menu is shown in figure 4-1.

DISPLAY MENU

SELECT OPTION BY PRESSING LETTER KEY

A - INITIALIZE PGP
B - DISPLAY GRAPHIC
C - CLEAR SCREEN
D - CLEAR SCREEN AREA
E - ANNOTATE DISPLAY

Z - ** Return to Main Menu **

Figure 4-1. Display Menu

INITIALIZE PGP

Before you can use the display subroutine, the display must be turned on and the PGP programs and variables loaded into the PGP. (Whenever the PGP is turned off, the memory is erased and must be reloaded.)

To initialize the PGP, first:

> TURN ON POWER to the PGP and the CONRAC units. The red light on the front of the PGP should come on and the CONRAC screen should be illuminated.

If the PGP light fails to come on, press RESET on the controlling WANG CRT. If it still does not come on, verify that the unit has power. If the unit has power and the light still fails, seek professional help.

If the CONRAC does not illuminate, try adjusting the brightness and contrast controls. If screen is still dark, check connections to power and to the PGP. If you still have a dark screen, seek professional help.

If the CONRAC screen appears wavy or flickers violently, there is probably some interference on the power lines. Try to isolate the power supply for the CONRAC and PGP from electrical interference.

When the units have power on and are performing properly, you may initialize the PGP by selecting option A on the Display Menu.

The program will load the PGP operating system and overlay programs and then load the Video Lookup Table (VLT). As the PGP operating system takes control of the unit, the CONRAC display screen should go momentarily dark and a small square should appear in one corner of the display screen. (If the CONRAC unit has been rotated to place the long axis of the screen vertically, the square will be in the lower left corner. If the unit has not been rotated, it will appear in the upper left corner.) The square will remain only briefly and serves to indicate that the PGP operating program is functioning.

When the operating system, overlays, and VLT are loaded, the program will ask:

TYPE 1 FOR LIGHT SCREEN

If you wish the CONRAC screen to remain dark,

PRESS: RETURN

If you wish the CONRAC screen to be illuminated (white background),

PRESS: 1

The program will set the background shade and will return to the Display Menu.

DISPLAY A GRAPHIC

The primary means of verifying the accuracy of scanning or enhancing a graphic is to display the results on the CONRAC unit. Only graphics scanned at 512 resolution or less can be entirely displayed. Any type of graphic file (normal, scaled, or compressed) can be displayed. If the file is not already scaled for the PGP, the display program will scale it as it is being displayed. This will add considerable time to the display operation. Graphics which are scaled or decompressed by the display program are not stored in their scaled/decompressed form.

The PGP memory can only accept 4000 characters at one time. Since most graphic files contain many more pixels than this, they must be displayed in pieces. Files will be displayed from left to right with as many rasters as will fit in the PGP memory being transmitted at one time.

The red light on the PGP unit should be on prior to sending data to the PGP. It will go out briefly while data is being transmitted and should immediately come back on. If the light stays out after the data transfer, the problem may be related to data or electronics. Seek professional help.

To display a graphic, select option B on the Display Menu. The program will first ask about the file to be displayed:

SELECT DISK DEVICE ---

If the indicated disk address is where your graphic file is stored, simply

PRESS: RETURN

If the device address is incorrect, or no device is shown,

TYPE the disk address of the device on which the graphic file is stored, and

PRESS: RETURN

The program will then ask:

SELECT GRAPHIC FILE ID (8 CHARACTERS) --------

If the file name is correct as shown, simply

PRESS: RETURN

If the name is not correct, or no name is shown,

TYPE the 8-character ID of the graphic file to be displayed, and

PRESS: RETURN

Next, the program will ask how the file is to be displayed:

SELECT MEMORY PLANES (0-15) ?

SELECT GATE LATCHES (0-15) ?

Each pixel sent to the PGP is a 4-bit value representing a number from 0 to 15. Each bit is stored in one of the available memory planes. For the data in a memory plane to be displayed on the CONRAC CRT, the corresponding latch must be on. To display all available data, select 15 memory planes and 15 gate latches. For a more detailed discussion of memory gating in the PGP refer to appendix F.

TYPE the number corresponding to the memory planes/latches desired (15 for all available), and

PRESS: RETURN

Next, the program will ask how big the graphic file should be:

SELECT ZOOM FACTOR (0-2) ?

A zoom factor of 1 doubles the size of the digitized graphic along both axes. A zoom factor of 2 quadruples the original graphic size along both axes. Only these 2 zoom factors are available. If the zoomed graphic will not fit on the CONRAC display screen, only that portion which will fit is displayed. A zoom factor of 0 does not alter the original size.

PRESS the number key corresponding to the zoom factor desired.

Finally, the program will ask you where you want the graphic to appear on the display screen:

SELECT X-COORD (↑) (0-639) ?

SELECT Y-COORD (→) (0-511) ?

The graphic display area is specified in terms of an X-Y coordinate grid of 640 by 512 pixels. The first value (0-639) is the position of the top of the graphic. The second value (0-511) is the location of the left edge of the graphic. Be sure there is enough space for the graphic.

TYPE the value for the location of the top of the graphic, and

PRESS: RETURN

TYPE the value for the location of the left edge of the graphic, and

PRESS: RETURN

The program will now transfer the display instructions and graphic data to the PGP. It will return to the Display Menu when finished.

CLEAR THE DISPLAY SCREEN

This option permits you to erase all displayed data on the CONRAC display screen. It also provides the option of selecting the background value for the display screen. The PGP must have been initialized prior to using this program and the red light on the front of the PGP unit must be on. If the PGP has been initialized, but the light is out, press RESET on the controlling WANG CRT before proceeding.

To clear the CONRAC display screen, select option C on the Display Menu.

The CONRAC display screen should go dark; then the program will ask:

TYPE 1 FOR LIGHT SCREEN

If you wish a dark background, then

PRESS: RETURN

If you wish a white background, then

PRESS: 1

The program will set the appropriate background and will return to the Display Menu.

CLEAR DISPLAY SCREEN AREA

This option is useful when you want to erase only a portion of the CONRAC display screen and leave the remaining display intact. Any rectangular area can be reset to all dark or all white pixels.

To clear an area on the CONRAC display screen, select option D on the Display Menu.

The program will display the following instruction on the WANG CRT and turn on the cursor on the CONRAC CRT.

MOVE CURSOR USING FUNCTION KEYS

5 - STEP DOWN	11 - AUTO RIGHT
6 - STEP UP	12 - STEP RIGHT
21 - AUTO DOWN	13 - STEP LEFT
22 - AUTO UP	14 - AUTO LEFT
10 - ENTER X-Y	ANY KEY STOPS AUTO MOVE

Use the function keys at the top of the WANG CRT keyboard to move the cursor. Note that keys 21 and 22 are keys 5 and 6 respectively with the shift key depressed. After you select an automatic move, any key depression will stop the cursor. The cursor will wrap around the CONRAC display screen both horizontally and vertically.

NOTE: The cursor is always a white cross whose center determines the cursor location. The cursor can not be seen against a white background.

The program will ask you to establish the bounds of the area to be cleared:

MOVE CURSOR TO UPPER LEFT CORNER OF
AREA TO BE CLEARED
THEN PRESS 'RETURN'

MOVE CURSOR TO LOWER RIGHT CORNER OF
AREA TO BE CLEARED
THEN PRESS 'RETURN'

You may accomplish this task in either of two ways, or in a combination of the two. You may physically move the cursor using the

function keys, or you may type in the cursor coordinates using function key 10.

To physically move the cursor, use the function keys to position the cursor at the upper left corner of the area to be cleared, then

PRESS: RETURN

Then, move the cursor to the lower right corner of the area to be cleared as you did above, and

PRESS: RETURN

To enter coordinates for the two corners,

PRESS: FUNCTION KEY 10

The program will display:

IX (!), IY (-]) ?

TYPE the X-coordinate value (0-639), a comma (,), the Y-coordinate value (0-511), and

PRESS: RETURN

Then type in the desired coordinates for the upper left corner of the area to be cleared.

Then repeat the process and type in the coordinates for the lower right corner of the area to be cleared, and

PRESS: RETURN

At this point the program will ask which background you want in the area to be cleared:

SELECT CLEAR VALUE

(0 = Black; 1 = White)

If you wish a dark background in the cleared area,

PRESS: 0

If you wish a white background in the cleared area,

PRESS: 1

The program will now clear the area you defined and will return to the Display Menu.

ANNOTATE DISPLAY

The Annotation System can be loaded from the Display Menu by selecting option E. Refer to section VI for a discussion of the Annotation System.

SECTION V

ENHANCING A GRAPHIC

INTRODUCTION

Graphic enhancement includes any programmatic change to a graphic data file. Such changes may be as simple as rescaling a graphic from 256 shades of gray to 16 for display on the CONRAC CRT, or as complex as a multi-level enhancement and expansion procedure. Routines exist within the Enhancement System to change the size of a graphic, to compress like values for more compact disk storage, to rescale the graphic to or from 16 shades of gray, and to perform sophisticated and complex graphic art routines.

The Enhancement System is loaded when you select option C on the Main Menu. The Enhancement Menu is shown in figure 5-1

ENHANCEMENT MENU

SELECT OPTION BY PRESSING LETTER KEY

A - SCALE GRAPHIC FOR PGP
B - REDUCE GRAPHIC
C - ENLARGE GRAPHIC
D - TRIM GRAPHIC
E - COMPRESS GRAPHIC
F - DECOMPRESS GRAPHIC
G - RESCALE GRAPHIC
H - ENHANCE GRAPHIC
I - ENHANCE EDGES
J - POSTERIZE GRAPHIC
K - SOLARIZE GRAPHIC
L - DISPLAY MENU

Z - ** Return to Main Menu **

Figure 5-1. Enhancement Menu

SCALE GRAPHIC FOR PGP

The Camera creates a graphic data file with 256 possible shades of gray per pixel. The Graphic Display System can only accept 16 shades of gray per pixel. All graphics to be displayed on the CONRAC unit must be scaled from 256 shades of gray to 16. If a graphic is only to be displayed once, this may be done by the display program itself. For those graphics which will be displayed several times, however, the scaling operation will permit much shorter display time when going to the CONRAC unit.

Scaling also has the advantage of reducing the raster length by 1/2. Disk space required to store a scaled file is frequently less. In a scanned file, each pixel requires 8 bits of storage. In a scaled file, only four bits are required per pixel. If the scaled file is compressed, even greater savings in disk space can be achieved as there is a much greater probability that like pixels will be clustered together.

Obviously, there will be a significant loss of resolution in a scaled file. If a file is destined to be typeset, the original file should always be retained for this purpose. If the file will only be displayed on the CONRAC unit, it must be scaled, so resolution is less of a question. Once a file has been scaled, the original file can not be regenerated by rescaling. A file can be built which again has 8 bits per pixel, but the relative values of each pixel will remain what they were in the scaled file.

The major enhancement routines will work on a scaled file, but much greater satisfaction will be obtained using the original scanned file.

To scale a graphic file for the PGP, select option A on the Enhancement Menu.

The program will then ask:

SELECT INPUT DISK DEVICE ---

If the disk address shown is where your graphic file was stored, simply

PRESS: RETURN

If the address is not correct, or no address is shown, then

TYPE the disk address for the graphic file to be processed, and

PRESS: RETURN

To return to the Enhancement Menu,

PRESS: ERASE

PRESS: RETURN

Next, the program will ask:

SELECT INPUT FILE ID (8 CHARACTERS) --------

If the file name shown on the screen is the one you want to process, simply

PRESS: RETURN

If the file name is not correct, or is not shown, then

TYPE the name of the graphic file to be processed, and

PRESS: RETURN

To select a different input device,

PRESS: ERASE

PRESS: RETURN

Next, the program will ask:

SELECT OUTPUT DISK DEVICE ---

If the disk address shown is correct, then

PRESS: RETURN

If the disk address shown is not correct, or no address is shown, then

TYPE the disk address at which you wish the output file to be saved, and

PRESS: RETURN

The program will generate a disk file ID in accordance with the conventions listed in appendix B by changing the sixth character of the input graphic file name to an 'S'.

When a valid output file name and address have been determined, the program will look at the input file to verify that it is a decompressed, 256 gray level graphic data file. If no errors are detected, the input file will be scaled to 16 gray levels. When the program is finished, it will display:

SCALING COMPLETE

OUTPUT FILE IS --------

To return to the Enhancement Menu,

PRESS any key

ERRORS. The following two error messages may appear while you are enhancing a graphic:

First error message:

OUTPUT FILE EXISTS - SCRATCH (Y OR N) ?

A file already exists on the specified output disk unit with the same name as your output file.

To write over the data in the existing file, destroying it,

PRESS: Y

To save the existing file and specify a new name and disk address for your output file,

PRESS: N

If you elect to save the existing file, the program will state:

TYPE OUTPUT DISK/FILE ID

TYPE the disk address at which you wish your output file to be stored, a slash (/), and the 8-character name for your output file, then

PRESS: RETURN

Second error message:

INVALID INPUT FILE

PRESS R TO START OVER; S TO STOP

The input file you selected is not suitable for the enhancement operation you are attempting. You may either specify a new input file or terminate the program and return to the Enhancement Menu.

To restart the program,

PRESS: R

To terminate the program,

PRESS: S

REDUCE A GRAPHIC

Graphic reduction decreases the size of a graphic by removing pixels and/or rasters proportionally from the file. Detail in the graphic will be distorted by specifying non-proportional reduction values.

The amount of reduction must be estimated by the user based on a display of the graphic or other determination. This program makes no assumptions and offers no assistance. Any graphic file may be input to the program. The output file will be of the same type as the input file. That is, if the input file was scaled and compressed, then the output file will also be scaled and compressed.

To reduce a graphic in size, select option B on the Enhancement Menu. The program will ask:

SELECT INPUT DISK DEVICE ---

If the disk address shown is where your graphic file was stored, simply

PRESS: RETURN

If the address is not correct, or no address is shown, then

TYPE the disk address for the graphic file to be processed, and

PRESS: RETURN

To return to the Enhancement Menu,

PRESS: ERASE

PRESS: RETURN

Next, the program will ask:

SELECT INPUT FILE ID (8 CHARACTERS) --------

If the file name shown on the screen is the one you want to process, simply

PRESS: RETURN

If the file name is not correct, or is not shown, then

TYPE the name of the graphic file to be processed, and

PRESS: RETURN

To select a different input device,

PRESS: ERASE

PRESS: RETURN

Next, the program will ask:

% OF X-AXIS REDUCTION (0-100) ?

The number entered now will be used to determine how many rasters to delete from the file.

TYPE a number representing the percentage of rasters to be removed from the file, and

PRESS: RETURN

Next, the program will ask:

% OF Y-AXIS REDUCTION ?

The number entered here determines the number of pixels to delete from each raster. Unless the amount of reduction is absolutely proportional to input size, any large number will tend to yield unsatisfactory results.

TYPE a number representing the percentage of pixels to be deleted from each raster, and

PRESS: RETURN

The program will generate the output file name by changing the seventh character of the input file name to an 'R'. The program will then ask for the disk address for the output file:

SELECT OUTPUT DISK DEVICE ---

If the disk address shown is correct, then

PRESS: RETURN

If the disk address shown is not correct, or no address is shown, then

TYPE the disk address at which you wish the output file to be saved, and

PRESS: RETURN

The program will now reconstruct the input file according to the information provided. The output file will be kept to the minimum size necessary to contain all data. (If the input file was compressed, the graphic file compression program will be called following reduction to compress the output file.)

ERRORS. The following error messages may appear while you are enhancing a graphic:

OUTPUT FILE EXISTS - SCRATCH (Y OR N) ?

A file already exists on the specified output disk unit with the same name as your output file.

To write over the data in the existing file, destroying it,

PRESS: Y

To save the existing file and specify a new name and disk address for your output file,

PRESS: N

If you elect to save the existing file, the program will state:

TYPE OUTPUT DISK/FILE ID

TYPE the disk address at which you wish your output file to be stored, a slash (/), and the 8-character name for your output file, then

PRESS: RETURN

ENLARGE A GRAPHIC

A graphic may be enlarged by duplicating pixels and/or rasters. This enlarges the area required to display the graphic. If the enlarging is not proportional to the original size of the graphic, some distortion will occur. The amount to enlarge a graphic must be estimated by the user based on a display of the graphic or some other determination. This program makes no assumptions and offers no assistance. Any graphic file may be enlarged. The output file will be of the same type as the input file.

To enlarge a graphic in size, select option C on the Enhancement Menu.

NOTE: This program functions in the same way as the graphic reducing program. For information on the steps used to carry out these functions, go back to reducing programs.

TRIM EDGES. If a graphic file contains some unwanted material along one or more edges, this material may be removed by deleting some rasters or pixels along the offending edge(s). This program allows you to eliminate any number of rasters or pixels from any edge. In addition to eliminating unwanted edge data, it permits any rectangular area of a graphic to be extracted into a separate graphic file.

Any graphic file may be input to the program. The output file will be of the same type as the input file.

To trim edges, select option D on the Enhancement Menu.

The program will then ask:

SELECT INPUT DISK DEVICE ---

If the disk address shown is where your graphic file was stored, simply

PRESS: RETURN

If the address is not correct, or no address is shown, then

TYPE the disk address for the graphic file to be processed, and

PRESS: RETURN

To return to the Enhancement Menu,

PRESS: ERASE

PRESS: RETURN

Next, the program will ask:

SELECT INPUT FILE ID (8 CHARACTERS) --------

If the file name shown on the screen is the one you want to process, simply

PRESS: RETURN

If the file name is not correct, or is not shown, then

TYPE the name of the graphic file to be processed, and

PRESS: RETURN

To select a different input device,

PRESS: ERASE

PRESS: RETURN

Next, the program will ask:

SELECT OUTPUT DISK DEVICE ---

If the disk address shown is correct, then

PRESS: RETURN

If the disk address shown is not correct, or no address is shown, then

TYPE the disk address at which you wish the output file to be saved, and

PRESS: RETURN

Next the program will advise you of the size of your input file:

NUMBER OF RASTERS ----

NUMBER OF PIXELS ----

The program will then ask for trim instructions, one side at a time:

PIXELS TO REMOVE FROM TOP ?

PIXELS TO REMOVE FROM BOTTOM ?

RASTERS TO REMOVE FROM LEFT ?

RASTERS TO REMOVE FROM RIGHT ?

In each case,

TYPE the number of pixels/rasters to remove, and

PRESS: RETURN

The program will now copy the input file, eliminating the requested rasters/pixels. The amount of data to remove must be estimated from a display of the input graphic file or by some other determination.

The program will generate the name for the output file by replacing the seventh character of the input file name with a 'T'.

NOTE: If the input file was compressed, then the graphic file compression program will be called to compress the output file.

ERRORS. The following error messages may appear while you are enhancing a graphic:

OUTPUT FILE EXISTS - SCRATCH (Y OR N) ?

A file already exists on the specified output disk unit with the same name as your output file.

To write over the data in the existing file, destroying it,

PRESS: Y

To save the existing file and specify a new name and disk address for your output file,

PRESS: N

If you elect to save the existing file, the program will state:

TYPE OUTPUT DISK/FILE ID

TYPE the disk address at which you wish your output file to be stored, a slash (/), and the 8-character name for your output file, then

PRESS: RETURN

COMPRESS A GRAPHIC FILE

Graphic files tend to take up considerable space on disk. Sometimes the space required for a graphic file can be reduced by compressing the file. The compression algorithm converts a string of 4 or more like pixels into a three-character code. Because of the overhead required by the compression routine, some files may actually increase slightly in size when compressed. Compression works best on sliced and scaled data files because of the high incidence of like pixels.

To compress a graphic file, select option E on the Enhancement Menu.

The program will then ask:

SELECT INPUT DISK DEVICE ---

If the disk address shown is where your graphic file was stored, simply

PRESS: RETURN

If the address is not correct, or no address is shown, then

TYPE the disk address for the graphic file to be processed, and

PRESS: RETURN

To return to the Enhancement Menu,

PRESS: ERASE

PRESS: RETURN

Next, the program will ask:

SELECT INPUT FILE ID (8 CHARACTERS) --------

If the file name shown on the screen is the one you want to process, simply

PRESS: RETURN

If the file name is not correct, or is not shown, then

TYPE the name of the graphic file to be processed, and

PRESS: RETURN

NOTE: The input file must be a non-compressed graphic data file.

To select a different input device,

PRESS: ERASE

PRESS: RETURN

Next, the program will ask:

SELECT OUTPUT DISK DEVICE ---

If the disk address shown is correct, then

PRESS: RETURN

If the disk address shown is not correct, or no address is shown, then

TYPE the disk address at which you wish the output file to be saved, and

PRESS: RETURN

Next, the program will ask:

SELECT WORK DISK UNIT ---

If the disk address displayed is available for a temporary work file, simply

PRESS: RETURN

If the disk address displayed is not usable as a work file location, then

TYPE the address of a disk unit which has sufficient free space for a temporary work file, and

PRESS: RETURN

NOTE: The work file will require at least as many sectors as the input graphic file. If there is not sufficient space in the work file, then compression will not reduce the overall file size and should not be used.

NOTE: The space used by the work file will be returned to the system when the program terminates.

The program will now compress the input file into the work file. When the compression is complete, the program will generate an output file name by replacing the sixth character of the input file name with a 'C'. It will then create the output file and copy the work file contents into it. The work file will then be released back to the system, and the program will return to the Enhancement Menu.

ERRORS. The following error messages may appear while you are enhancing a graphic:

OUTPUT FILE EXISTS - SCRATCH (Y OR N) ?

This means a file already exists on the specified output disk unit with the same name as your output file.

To write over the data in the existing file, destroying it,

PRESS: Y

To save the existing file and specify a new name and disk address for your output file,

PRESS: N

If you elect to save the existing file, the program will state:

TYPE OUTPUT DISK/FILE ID

TYPE the disk address at which you wish your output file to be stored, a slash (/), and the 8-character name for your output file, then

PRESS: RETURN

DECOMPRESS A GRAPHIC FILE

It may be convenient when using a graphic file for processing to decompress the file first. This would avoid time consuming decompression and recompression during some enhancement procedures. It is also necessary to decompress a graphic prior to most typesetter routines as full raster data is usually required. This routine will reconstruct the original file from a compressed graphic data file.

To decompress a graphic data file, select option F on the Enhancement Menu.

The program will then ask:

SELECT INPUT DISK DEVICE ---

If the disk address shown is where your graphic file was stored, simply

PRESS: RETURN

If the address is not correct, or no address is shown, then

TYPE the disk address for the graphic file to be processed, and

PRESS: RETURN

To return to the Enhancement Menu,

PRESS: ERASE

PRESS: RETURN

Next, the program will ask:

SELECT INPUT FILE ID (8 CHARACTERS) --------

If the file name shown on the screen is the one you want to process, simply

PRESS: RETURN

If the file name is not correct, or is not shown, then

TYPE the name of the graphic file to be processed, and

PRESS: RETURN

NOTE: The input file must be a compressed graphic data file.

To select a different input device,

PRESS: ERASE

PRESS: RETURN

Next, the program will ask:

SELECT OUTPUT DISK DEVICE ---

If the disk address shown is correct, then

PRESS: RETURN

If the disk address shown is not correct, or no address is shown, then

TYPE the disk address at which you wish the output file to be saved, and

PRESS: RETURN

Next the program will ask you to supply a name for the output file:

SELECT OUTPUT FILE ID

TYPE the 8-character name for your output file, and

PRESS: RETURN

The program will now decompress the graphic file. When it is finished, it will return to the Enhancement Menu.

NOTE: There will be no pure black or white shades in the output file as these values are used for control characters for the compression/decompression algorithms.

ERRORS. The following error messages may appear while you are enhancing a graphic:

OUTPUT FILE EXISTS - SCRATCH (Y OR N) ?

This means a file already exists on the specified output disk unit with the same name as your output file.

To write over the data in the existing file, destroying it,

PRESS: Y

To save the existing file and specify a new name and disk address for your output file,

PRESS: N

If you elect to save the existing file, the program will state:

TYPE OUTPUT DISK/FILE ID

TYPE the disk address at which you wish your output file to be stored, a slash (/), and the 8-character name for your output file, then

PRESS: RETURN

RESCALE A GRAPHIC

Should the original of a scaled graphic be lost, this routine will reconstruct an 8-bit pixel file which will approximate the original. It can not reconstruct the original pixel values, however, but only create a file with 16 shades of gray spread evenly through the 256 gray shade range.

To rescale a file, select option G on the Enhancement Menu.

The program will then ask:

SELECT INPUT DISK DEVICE ---

If the disk address shown is where your graphic file was stored, simply

PRESS: RETURN

If the address is not correct, or no address is shown, then

TYPE the disk address for the graphic file to be processed, and

PRESS: RETURN

To return to the Enhancement Menu,

PRESS: ERASE

PRESS: RETURN

Next, the program will ask:

SELECT INPUT FILE ID (8 CHARACTERS) --------

If the file name shown on the screen is the one you want to process, simply

PRESS: RETURN

If the file name is not correct, or is not shown, then

TYPE the name of the graphic file to be processed, and

PRESS: RETURN

NOTE: The input file must be a scaled graphic data file.

To select a different input device,

PRESS: ERASE

PRESS: RETURN

Next, the program will ask:

SELECT OUTPUT DISK DEVICE ---

If the disk address shown is correct, then

PRESS: RETURN

If the disk address shown is not correct, or no address is shown, then

TYPE the disk address at which you wish the output file to be saved, and

PRESS: RETURN

Next the program will ask you to supply a name for the output file:

SELECT OUTPUT FILE ID

TYPE the 8-character name for your output file, and

PRESS: RETURN

The program will now rescale the input graphic file into the output file. When it is finished, it will return to the Enhancement Menu.

ERRORS. The following error messages may appear while you are enhancing a graphic:

OUTPUT FILE EXISTS - SCRATCH (Y OR N) ?

A file already exists on the specified output disk unit with the same name as your output file.

To write over the data in the existing file, destroying it,

PRESS: Y

To save the existing file and specify a new name and disk address for your output file,

PRESS: N

If you elect to save the existing file, the program will state:

TYPE OUTPUT DISK/FILE ID

TYPE the disk address at which you wish your output file to be stored, a slash (/), and the 8-character name for your output file, then

PRESS: RETURN

ENHANCE THE GRAYSCALE IN A GRAPHIC

One purpose of this routine is to change the contrast of a photograph. If the contrast in an original or digitized photograph is poor and is composed of muddy gray tones without good blacks or whites, this routine will allow you to push the darkest of the grays to a deep black, and push the lights of the grays to a clean white. In turn, if a digitized photograph seems to be mostly blacks and whites-too much contrast-the routine can be used to generate more middle grays. The result, a photograph with a full range of tones from black to white. This is a general purpose grayscale enhancement routine which can be used to achieve a variety of other special effects. With skillful manipulation, it can totally remake a photograph or other graphic. The secret to successful enhancement is the proper selection of input values. Since this will depend entirely on the content of the input graphic and the final effect desired, only some general guidelines can be given here. The user should experiment with this routine and the graphic analysis routines (see section VIII) to determine the optimum values for any particular enhancement.

The program works by shifting the values of the pixels within a specified range. The mid-point identifies that point in the range of pixel values to be shifted to the middle gray tone. The values of the remaining pixels will be pushed toward the extreme ends of the range from that midpoint. The amount of push may be controlled through the enhancement factor. Up to 10 unique ranges of pixel values may be specified. The program also includes an option to expand the input pixel range over the entire range of available pixel values.

For example: Suppose that the input file contains a range of pixel values from 41 through 185:

If you want to enhance the white areas:

Select range: 100-185
Select mid-point: 25 (percent)
Select enhancement factor: 3

If you want to enhance the black areas:

Select range: 41-70
Select mid-point: 75 (percent)
Select enhancement factor: 3

If you want to spread pixels to both extremes:

Select range: 41-80
Select mid-point: 100 (percent)
Select enhancement factor: 3

Select range: 81-185
Select mid-point: 1 (percent)
Select enhancement factor: 3

Refer to appendix E for enhancement examples.

To enhance the grayscale in a graphic file, select option H on the Enhancement Menu.

The program will then ask:

SELECT INPUT DISK DEVICE ---

If the disk address shown is where your graphic file was stored, simply

PRESS: RETURN

If the address is not correct, or no address is shown, then

TYPE the disk address for the graphic file to be processed, and

PRESS: RETURN

To return to the Enhancement Menu,

PRESS: ERASE

PRESS: RETURN

Next, the program will ask:

SELECT INPUT FILE ID (8 CHARACTERS) --------

If the file name shown on the screen is the one you want to process, simply

PRESS: RETURN

If the file name is not correct, or is not shown, then

TYPE the name of the graphic file to be processed, and

PRESS: RETURN

To select a different input device,

PRESS: ERASE

PRESS: RETURN

Next, the program will ask:

SELECT OUTPUT DISK DEVICE ---

If the disk address shown is correct, then

PRESS: RETURN

If the disk address shown is not correct, or no address is shown, then

TYPE the disk address at which you wish the output file to be saved, and

PRESS: RETURN

Next the program will ask you to supply a name for the output file:

SELECT OUTPUT FILE ID

TYPE the 8-character name for your output file, and

PRESS: RETURN

The program will generate the output file name by changing the sixth character of the input file name to an 'L'. After verifying the input and output files, the program will ask how many unique ranges of pixel values you want to specify:

HOW MANY RANGES (1-10) ?

TYPE the number of ranges of pixel values you wish to enhance, and

PRESS: RETURN

You need specify only those ranges you actually wish to manipulate. Any pixel value not in a specified range will be placed in the output file unchanged, except for optional range expansion. You must specify at least one range.

Next the program will display the pixel range for the input file and ask you to specify, in turn, the lower limit, upper limit, mid-point, and enhancement factor for each range.

LIST RANGES FROM LOWER TO UPPER
CURRENT RANGE IS ---- TO ----
LOWER LIMIT OF RANGE ---- ?
UPPER LIMIT OF RANGE ---- ?
MID-POINT (% OF RANGE) ?
ENHANCEMENT FACTOR (1-5) ?

Enter the requested values for each of the ranges you requested. Range 1 should be the range closest to the lower limit of the input

file; the last range input should be the range closest to the upper limit of the input file. The entire range of the input file need not be covered, nor must a range begin/end at the lower/upper limit of the input file (nor can it exceed those limits). Ranges do not have to be contiguous.

The mid-point value is entered as a percentage of the range. A value of 1 indicates the lower limit of the range (all values in the range pushed toward the upper limit); and a value of 100 indicates the upper limit of the range (all values in the range pushed toward the lower limit); a value of 50 indicates the middle of the range (all values pushed from the middle equally toward either end).

An enhancement factor of 1 is essentially no enhancement at all. Values of 4 and 5 do not normally show any noticeable improvement over value of 3, but may be applicable to some special situations.

When the values for all specified ranges have been entered, the program will ask:

RANGE OPTION ?

O - ORIGINAL

E - EXPANDED

To keep the same range of values as in the input file,

PRESS: O

To expand the range of values throughout the 256 gray level range,

PRESS: E

The program will now examine the input file and convert the pixel values according to the parameters specified. When the program is finished, it will return to the Enhancement Menu.

ERRORS. The following error messages may appear enhancing a graphic:

OUTPUT FILE EXISTS - SCRATCH (Y OR N) ?

A file already exists on the specified output disk unit with the same name as your output file.

To write over the data in the existing file, destroying it,

PRESS: Y

To save the existing file and specify a new name and disk address for your output file,

PRESS: N

If you elect to save the existing file, the program will state:

TYPE OUTPUT DISK/FILE ID

TYPE the disk address at which you wish your output file to be stored, a slash (/), and the 8-character name for your output file, then

PRESS: RETURN

EDGE ENHANCEMENT

This routine identifies edges (a dramatic change in value between adjacent pixels) and increases the value of the light pixel while decreasing the value of the dark pixel to dramatize the appearance of the edge. The program can identify horizontal or vertical edges, or both at once. An edge variance (the number of grayscale steps used to identify an edge) is defined by the user and can be altered until the desired effect is achieved.

To enhance edges, select option I on the Enhancement Menu.

The program will ask for the type of edge you wish to enhance:

SELECT ENHANCEMENT TYPE

1 - VERTICAL

2 - HORIZONTAL

3 - BOTH

To enhance vertical edges only,

PRESS: 1

To enhance horizontal edges only,

PRESS: 2

To enhance both horizontal and vertical edges,

PRESS: 3

The program will then ask:

SELECT INPUT DISK DEVICE ---

If the disk address shown is where your graphic file was stored, simply

PRESS: RETURN

If the address is not correct, or no address is shown, then

TYPE the disk address for the graphic file to be processed, and

PRESS: RETURN

To return to the Enhancement Menu,

PRESS: ERASE

PRESS: RETURN

Next, the program will ask:

SELECT INPUT FILE ID (8 CHARACTERS) --------

If the file name shown on the screen is the one you want to process, simply

PRESS: RETURN

If the file name is not correct, or is not shown, then

TYPE the name of the graphic file to be processed, and

PRESS: RETURN

To select a different input device,

PRESS: ERASE

PRESS: RETURN

Next, the program will ask:

SELECT OUTPUT DISK DEVICE ---

If the disk address shown is correct, then

PRESS: RETURN

If the disk address shown is not correct, or no address is shown, then

TYPE the disk address at which you wish the output file to be saved, and

PRESS: RETURN

Next the program will ask:

SELECT OUTPUT FILE ID

TYPE the 8-character name for your output file, and

PRESS: RETURN

The program will read the input graphic file from left to right and will enhance the edges selected. When the program is finished, it will return to the Enhancement Menu.

NOTE: Edges are always enhanced from left to right and from the top down.

ERRORS. The following error messages may appear while you are enhancing a graphic:

OUTPUT FILE EXISTS - SCRATCH (Y OR N) ?

This means a file already exists on the specified output disk unit with the same name as your output file.

To write over the data in the existing file, destroying it,

PRESS: Y

To save the existing file and specify a new name and disk address for your output file,

PRESS: N

If you elect to save the existing file, the program will state:

TYPE OUTPUT DISK/FILE ID

TYPE the disk address at which you wish your output file to be stored, a slash (/), and the 8-character name for your output file, then

PRESS: RETURN

POSTERIZATION

The posterization routine is used to achieve artistic designs where aesthetics is important in book covers or posters. This technique will change a specified range of pixel values to one particular value. Common selections include all black, all white, and one or two shades of gray. This simulates the graphic arts technique of silk screening.

To posterize a graphic, select option J on the Enhancement Menu.

The program will then ask:

SELECT INPUT DISK DEVICE ---

If the disk address shown is where your graphic file was stored, simply

PRESS: RETURN

If the address is not correct, or no address is shown, then

TYPE the disk address for the graphic file to be processed, and

PRESS: RETURN

To return to the Enhancement Menu,

PRESS: ERASE

PRESS: RETURN

Next, the program will ask:

SELECT INPUT FILE ID (8 CHARACTERS) --------

If the file name shown on the screen is the one you want to process, simply

PRESS: RETURN

If the file name is not correct, or is not shown, then

TYPE the name of the graphic file to be processed, and

PRESS: RETURN

To select a different input device,

PRESS: ERASE

PRESS: RETURN

Next, the program will ask:

SELECT OUTPUT DISK DEVICE ---

If the disk address shown is correct, then

PRESS: RETURN

If the disk address shown is not correct, or no address is shown, then

TYPE the disk address at which you wish the output file to be saved, and

PRESS: RETURN

Next the program will ask:

SELECT OUTPUT FILE ID

TYPE the 8-character name for your output file, and

PRESS: RETURN

Next, the program will display the range of pixel values in the input file and ask which values are to be changed:

PIXEL RANGE IS --- TO ---

TYPE RANGE TO RESET

START VALUE ?

END VALUE ?

NEW VALUE ?

A maximum of 10 ranges may be specified. Start with the range closest to the lower limit of the file and proceed in ascending order to the range closest to the upper limit of the file. Type the lowest value of each range, the highest value of the range, and the new value to be assigned to all pixels in the range. To terminate the list of ranges, type -1 as the range start value.

For example: Suppose that the range of pixels in a file is 41 through 185. A typical posterization might be:

Range 1:
Start: 41
End: 55
New Value: 1

Range 2:
Start: 56
End: 150
New Value: 72

Range 3:
Start: 151
End: 185
New Value: 255

Range 4:
Start: -1

When the program has posterized the input file it will return to the Enhancement Menu.

SOLARIZATION

Solarization is a graphic art technique which can also be used where aesthetics is important or special effects are desired. This program attempts to emulate the effects of the photographic process called solarization by changing all defined edges to white while the remainder of the graphic is set to black. The overall effect can be quite dramatic.

The program will first ask:

SELECT INPUT DISK DEVICE ---

If the disk address shown is where your graphic file was stored, simply

PRESS: RETURN

If the address is not correct, or no address is shown, then

TYPE the disk address for the graphic file to be processed, and

PRESS: RETURN

To return to the Enhancement Menu,

PRESS: ERASE

PRESS: RETURN

Next, the program will ask:

SELECT INPUT FILE ID (8 CHARACTERS) --------

If the file name shown on the screen is the one you want to process, simply

PRESS: RETURN

If the file name is not correct, or is not shown, then

TYPE the name of the graphic file to be processed, and

PRESS: RETURN

To select a different input device,

PRESS: ERASE

PRESS: RETURN

Next, the program will ask:

SELECT OUTPUT DISK DEVICE ---

If the disk address shown is correct, then

PRESS: RETURN

If the disk address shown is not correct, or no address is shown, then

TYPE the disk address at which you wish the output file to be saved, and

PRESS: RETURN

Next the program will ask:

SELECT OUTPUT FILE ID

TYPE the 8-character name for your output file, and

PRESS: RETURN

Next, the program will ask for the definition of an edge:

TYPE EDGE VARIANCE (1-100)

The edge variance is the difference between two adjacent pixels. If the difference in value between two pixels is greater than the value specified, one of the pixels will be set to white. If vertical edge enhancement is used it will be the upper pixel. If horizontal edge enhancement is called for, it will be the left pixel. All pixels not set to white will be set to black.

TYPE the edge variance value, and

PRESS: RETURN

The input file will now be processed. The graphic will be examined from left to right and from the top to bottom. The edges determined by the specified limit will be set to white and all other pixels set to black. When the program is finished, it will return to the Enhancement Menu.

SECTION VI

ANNOTATING A DISPLAY

INTRODUCTION

The Annotation System allows you to draw virtually any kind of design desired including straight lines and arcs, or unique geometrical shapes. All of the annotations for a given screen display may be saved on disk and recalled for display or modification at any time. In addition to annotating the CONRAC display, the annotation file contains all necessary data to reconstruct the annotations on any suitable output medium. The annotation file may be directly or indirectly linked to a graphic data file for retrieval and processing by a program.

Prior to annotating a display, remember to turn on and initialize the PGP and CONRAC unit and to display the graphic to be annotated.

To load the Annotation System, select option E on the Display Menu. The Annotation Menu is shown in figure 6-1.

ANNOTATION MENU

SELECT OPTION BY PRESSING LETTER KEY

A - CREATE ANNOTATION FILE

B - CHANGE ANNOTATION FILE

C - DISPLAY ANNOTATION FILE

D - PRINT ANNOTATION FILE

Figure 6-1. Annotation Menu

CREATE, CHANGE AND DISPLAY ANNOTATION FILE

With few exceptions, all procedures involved in creating, changing, or displaying an annotation file are the same. Select the desired option from the Annotation Menu and press the appropriate key: A, B, or C.

First the program will ask for the name and location of the annotation file:

SELECT DISK UNIT/ANNOTATION FILE ID

TYPE the address of the disk unit on which the annotation file has been, or is to be, stored; a slash (/); and the 8-character name of the annotation file, then

PRESS: RETURN

NOTE: By using the same first four characters for all files associated with the same original graphic, they can easily be retrieved in a block for subsequent processing. See also appendix B.

If you are creating a new annotation file, the program wil now ask:

NAME OF FILE BEING ANNOTATED ?

TYPE the 8-character name of the graphic file or overlay which you are annotating, and

PRESS: RETURN

NOTE: The name of the graphic or overlay being annotated is included in the annotation file. The purpose for this is to provide a programmatic

link from the annotation file to the file being annotated. No use is made of this information at this time by the Graphic Processing System. It will be needed, however, as routines are linked together in an automated authoring system.

If you are displaying an annotation file, refer to DISPLAYING ANNOTATIONS below. If you are changing an existing annotation file, the annotations in the file, if any, will be displayed on the CONRAC unit without further interaction.

Next, the Annotation Option Menu, figure 6-2, will be displayed on the WANG CRT and the cursor will be turned on within the CONRAC display screen.

```
MOVE CURSOR                ? - PRINT CURSOR LOCATION
 5 - STEP DOWN            11 - AUTO RIGHT
 6 - STEP UP              12 - STEP RIGHT
21 - AUTO DOWN            13 - STEP LEFT
22 - AUTO UP              14 - AUTO LEFT
10 - ENTER X-Y            ANY KEY STOPS AUTO MOVE

ANNOTATION OPTIONS
L - LINE, R - RECTANGLE, O - CIRCLE, A - ARROWHEAD
T - TEXT, C - ARC, V - DART, Y - POINT

FIGURE OPTIONS
D - DASHED LINES, F - FILL RECTANGLE,
N - REVERSE IMAGE, W - SET LINE WIDTH

EXECUTION OPTIONS
E - ENTER CURSOR, X - EXECUTE ANNOTATION,
K - KEEP ANNOTATION, P - DISPLAY ANNOTATION,
S - RESET INDEX, 'RETURN' - END PROGRAM
```

Figure 6-2. Annotation Option Menu

Below the Annotation Menu the program will ask you to enter your option:

```
------------------------------------------------------- --------

                          OPTION ?

------------------------------------------------------- -------
```

You may:

- PRESS a function key to move the cursor, or

  PRESS a letter key to select an annotation, figure, or execution option, or

  PRESS: RETURN to terminate the program.

Each of the available options is discussed in detail below.

MOVING THE CURSOR

The cursor on the CONRAC display screen can be moved using the function keys at the top of the WANG keyboard. Keys 5, 6, 12, and 13 move the cursor one pixel in the indicated direction each time the key is pressed. Keys 11, 14, 21, and 22 start the cursor moving in the indicated direction. The cursor will continue to move, wrapping around the screen when it comes to the end of a column or row, until any other key is pressed.

If you wish to know where the cursor is at any time, press the '?' key with the shift depressed. The location of the cursor will be displayed in an alphanumeric message at the bottom of the WANG CRT screen.

To move the cursor to a specific location on the CONRAC display screen,

PRESS: Function Key 10

The program will then ask:

```
------------------------------------------------------------------

                      IX (!), IY (-]) ?

------------------------------------------------------- -----
```

TYPE the new vertical position for the cursor (0-639), a comma (,), and the new horizontal position for the cursor (0-511), then

PRESS: RETURN

The cursor will be moved immediately to the new position.

ANNOTATION OPTIONS

An annotation is comprised of an annotation type code, one or more sets of coordinates, one or more figure options, and any required additional data.

You may structure and display an annotation any number of times before either accepting it or rejecting it. Once displayed on the CONRAC screen, however, the annotation can not be erased from the display screen (without also removing everything else in the vicinity). It may be changed and redisplayed in a new format, or purged from the file, but it will remain on the display screen until the screen is erased.

The following annotations are currently available. Each is specified by pressing the indicated letter key and responding to any subsequent data requests. Be sure to enter the required number of coordinate points for each annotation before trying to display it. Coordinates are entered using the ENTER CURSOR option discussed below.

L - Line: A straight line segment joining two sets of coordinates. A line may be dashed, have a reverse image, and have width. If an arrowhead is to be placed at the end of the line, the apex of the arrowhead must be the last set of coordinates entered.

R - Rectangle: A rectangle is defined by two sets of coordinates which are the ends of a diagonal of the rectangle. A rectangle may be filled, have line width, or have a reverse image.

O - Circle: A circle is defined by a center (the first set of coordinates entered) and any point on the circumference (the second set of coordinates entered). A circle may have line width and reverse image.

A - Arrowhead: The arrowhead entry must follow a line entry. The apex of the arrowhead will be the last set of coordinates entered for the preceding line. All

coordinates for the arrowhead will be generated automatically. Do not enter coordinates for an arrowhead !! The figure options for the arrowhead will be the same as those for the preceding line entry. These options may be altered after the initial arrowhead entry has been built.

T - Text: Prior to requesting a textual annotation, the cursor should be moved to the point at which the bottom left corner of the first character of text is to appear and the cursor position entered. The program will ask you to enter the font ID of the text. This must be a decimal number. (It will be converted to a two-byte binary number for storage in the annotation record.)

TYPE the font ID number, and

PRESS: RETURN

Next, the program will ask you to type a line of text. A maximum of 59 characters are allowed on a text line. You may edit the text line as you are typing it using the standard function keys, backspace key, etc.

TYPE the line of text, and

PRESS: RETURN

Text may have the reverse image option.

NOTE: There is limited room in the annotation file. Large amounts of textual data should be avoided.

NOTE: The font ID is not now used by the Graphic Processng System. It is provided only as an interface to a typesetter. There is only one font available on the CONRAC display unit.

C - Arc: Arcs with or without arrowheads are drawn in 45 degree segments and may begin anywhere on the circumference of the circle. The first set of coordinates entered must be the center of the circle, the second set the apex of the arrowhead on the circumference of the circle. Arcs may have line width and reverse image. The program will ask for some additional information:

DIRECTION OF ARROW ?
L - COUNTERCLOCKWISE
R - CLOCKWISE

If the arc is to be drawn counterclockwise from the arrowhead apex,

PRESS: L

If the arc is to be drawn clockwise from the arrowhead apex,

PRESS: R

Then the program will ask:

NUMBER OF 45 DEG SEGMENTS IN ARC (1-8)

TYPE the number of segments, and
PRESS: RETURN

Finally, the program will ask:

ARROWHEAD (Y OR N) ?

If you want an arrowhead at the end of your arc, then

PRESS: Y

If you do not want an arrowhead, then

PRESS: N

V - Dart: A dart may have either a horizontal or vertical base. The first set of coordinates entered are the tip of the dart. The second set of coordinates entered are the center of the base. Darts may have reverse image option. The program will ask you to indicate which type of dart you want:

WHAT IS DART TYPE ?
1 - VERTICAL
2 - HORIZONTAL

To select a vertical base,

PRESS: 1

To select a horizontal base,

PRESS: 2

Y - POINT: A point consists of a dot placed at a set of coordinates with a 1-8 character ID printed next to it. Points may have reverse image. The program will ask you to enter the point ID:

TYPE POINT ID (MAX. 8 CHAR.)

TYPE the value for the point ID, and

PRESS: RETURN

NOTE: Points were intended to serve as a programmatic link between graphics on the same overlay. As such they could be used for construction of other annotations. They are not used by the Graphic Processing System.

FIGURE OPTIONS

D - Dashed Lines: This function turns on or off the dashed line attribute for the current annotation. It may be used with lines or rectangles only.

F - Fill Rectangle: This function will turn on or off the fill attribute for a rectangle. A filled rectangle is a solid tone (white normally, black when reversed). A non-filled rectangle is a white or black outline.

N - Reverse Image: This function reverses the tone of the current annotation. If it was white (default), it will make it black; if it was black, it will make it white. It may be used with any annotation.

W - Set Line Width: This function allows you to set the line width for the current annotation from 1 (default) to 8. Line width may be set for lines, circles, arcs, and arrowheads.

NOTE: All figure options will remain in effect until they are changed.

EXECUTION OPTIONS

E - Enter Cursor: This command saves the current position of the cursor in the current annotation record. In those annotations which require two sets of coordinates, the value in the second (rightmost) coordinate position is moved to the first coordinate position and then the cursor is saved in the second coordinate position. In those annotations requiring only one set of coordinates, the new value replaces the previous value. It is important that coordinate values be entered in the correct order for the annotation you are building!!

X - Execute Annotation: The current annotation record will be displayed on the CONRAC display screen.

K - Keep Annotation: The pointer to the annotation file will be positioned at the next record. All previous records will be retained when the file is saved on disk.

S - Reset Pointer: The pointer to the annotation file will be reset to point to the first record in the file.

P - Display Annotation: Refer to the section DISPLAYING ANNOTATIONS which is discussed below.

RETURN - End Program: The annotation file will be closed and will be written on disk. Only annotation records which have been explicitly kept will be saved.

DISPLAYING ANNOTATIONS

To display an annotation select option C from the annotation menu (figure 6-1).

The program will ask how you wish to display annotations:

TYPE S FOR SINGLE ANNOTATION; A FOR ALL AT ONCE

To Display all annotations in the file at one time,

PRESS: A

To review the annotations one at a time, with the option of deleting unwanted annotations,

PRESS: S

NOTE: If you selected the option of changing an annotation file on the Annotation Menu, the program proceeds as though you had selected option A above.

If you select the all-at-once option, all annotations in the file will be displayed on the CONPAC display screen and the program will return to the Annotation Option Menu.

If you select the one-at-a-time option, the annotation currently being pointed to will be displayed on the CONRAC unit. Then the program will ask:

PRESS D TO DELETE ANNOTATION; E TO END

If you want to delete the current annotation from the file,

PRESS: D

If you want to keep the current annotation,

PRESS: RETURN

If you want to change the current annotation, or terminate the program,

PRESS: E

Unless you terminate the display function, the next annotation in the file will be displayed. When all annotations have been displayed, or you select the 'END' option, the program will return to the Annotation Option Menu. The file pointer will be pointing to either the current annotation ('END' option) or the next available record in the file.

ERRORS. The following error messages may be displayed on the WANG CRT screen by the program:

FILE EXISTS - SCRATCH (Y OR N) ?

You are creating an annotation file, and a file by the name you have indicated already exists on the disk unit you specified.

To write over the contents of the existing file, destroying them:

PRESS: Y

To save the existing file, and create a new file with a new name and/or disk unit:

PRESS: N

If the following message appears:

UNKNOWN REQUEST TYPE

PRESS ANY KEY TO CONTINUE

---

a key was pressed at the Annotation Option Menu which did not correspond to an existing option. Press any key to reset the program.

If the following message appears:

ARROWHEAD MUST FOLLOW LINE ENTRY

PRESS ANY KEY TO CONTINUE

---

you pressed A at the Annotation Option Menu and the previous annotation in the file is not a line entry. Press any key to reset the program.

If the following message appears:

OPTION NOT NOW ACTIVE

---

the option you selected at the Annotation Option Menu is not currently supported by the program. Please select another option.

If the following message appears:

END OF FILE

---

there is no more room left in the annotation file. Close the file and create a new file to continue building your annotation, or delete an existing annotation to make room in the file. If you were building a text entry, part of the entry may be in the file.

If the following message appears:

END OF FILE NOT FOUND

---

the end of file flag was not found while displaying annotations. The file may be full. One or more annotations may be in error. The file should be examined and corrective action taken before continuing to use the file.

PRINT ANNOTATION FILE

This program will print the contents of the annotation file on a line printer or the WANG CRT screen. It can be used to make a permanent record of an annotation file or to help in locating suspected errors.

To print an annotation file, select option D on the Annotation Menu. The program will ask you to select the disk unit and the name of the annotation file.

SELECT DISK UNIT/ANNOTATION FILE ID

TYPE the address of the disk unit on which the annotation file resides, a slash (/), and the 8-character name of the annotation file, then

PRESS: RETURN

Next, the program will ask where you want the file printed:

WHICH OUTPUT DEVICE ?

TYPE the address of the output device on which you want to print the file contents, and

PRESS: RETURN

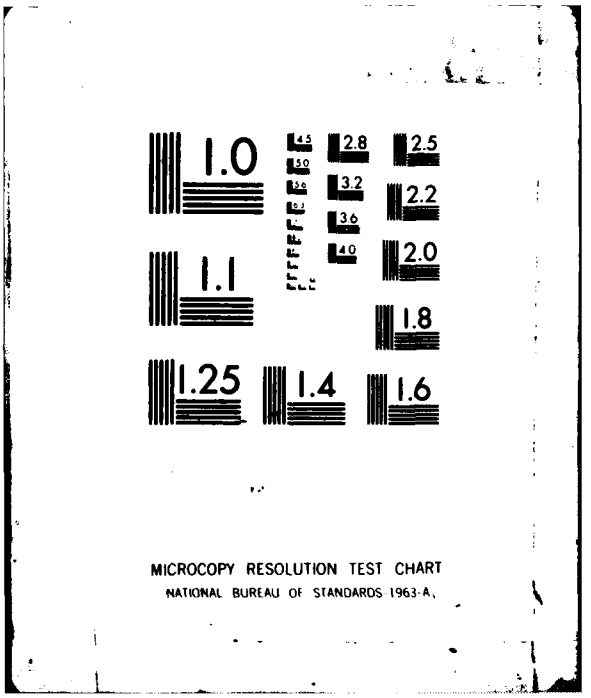
NOTE: The WANG CRT screen is device 005.

The program will now print the contents of the annotation file, starting a new line with each annotation. See appendix G for a sample listing.

If the end of file flag is not found, the program will terminate with the following message:

AD-A109 779 TRAINING ANALYSIS AND EVALUATION GROUP (NAVY) ORLANDO FL F/G 9/2
TEXT AND ILLUSTRATION PROCESSING SYSTEM (TIPS) USER'S MANUAL. V--ETC(U)
AUG 81 R COX, R BRABY

UNCLASSIFIED TAEG-107 NL


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

NO END OF FILE FOUND

When it is finished, the program will return to the Annotation Menu.

SECTION VII

CREATING GRAPHIC OVERLAYS

INTRODUCTION

An overlay is a single graphic file which contains other graphic files. Having a single file on a page is essential if the data is to drive a phototypesetter, and will be used for that purpose when the interface with the typesetter is complete. An overlay is usually a graphic file of 512 rasters of 512 to 640 pixels each It is designed to fill a full CONRAC display screen and emulate a document page. The benefit in using an overlay is that the included graphics are always positioned at the same place each time the 'page' is displayed, and annotations may be generated which lie between graphics as well as on them. A single annotation file can contain all of the annotations for several graphics and additional annotations linking and overlaying these several graphics.

To load the graphic overlay system, select option E on the Graphics Main Menu shown in figure 2-5 (page 17). The Graphic Overlay Menu is shown in figure 7-1.

GRAPHIC OVERLAY MENU

SELECT OPTION BY PRESSING LETTER KEY

A - CREATE OVERLAY FILE
B - ADD GRAPHIC TO OVERLAY FILE
C - CLEAR AREA IN OVERLAY FILE
D - DISPLAY MENU

Z - ** Return to Main Menu **

Figure 7-1. Graphic Overlay Menu

CREATE AN OVERLAY FILE

Selecting the proper size for an overlay file is of some import. It should be large enough to hold all graphic files and anticipated annotations, but no larger. The maximum size for a full page display on the CONRAC CRT is 512 rasters by 640 pixels. An actual overlay designed for the CONRAC display will seldom need to be this large. Allowance for margins and text area will usually reduce the total overlay size. The smaller the overlay, the less disk space it will require and the less time it will require to display it.

All graphics to be placed in an overlay should be enhanced, reduced, enlarged, and/or trimmed as desired before placing them in the overlay file.

Although this discussion centers primarily on overlays designed for the CONRAC unit, an overlay may be designed for any output media, including typesetters. In such a case, the overlay size will be determined by the capabilities of the output media and may vary considerably from those discussed herein. The general procedures discussed, however, will apply equally to any overlay file generation or use.

To create a graphic overlay file, select option A on the Graphic Overlay Menu. The program will first ask:

TYPE DISK UNIT/OVERLAY FILE ID

TYPE the address of the disk unit on which you wish to store your overlay file, a slash (/), and the 8-character name for the overlay file, then

PRESS: RETURN

Next, the program will ask how big the overlay file is to be:

TYPE FILE SIZE

NUMBER OF RASTERS ?

PIXELS PER RASTER ?

TYPE The number of rasters to be in the overlay file (1-512), and

PRESS: RETURN

Then,

TYPE The number of pixels per raster (1-640), and

PRESS: RETURN

Finally, the program will ask you what type of background you want for your overlay,

---

SELECT BACKGROUND VALUE

1 - WHITE

2 - BLACK

3 - OTHER

To select a white background,

PRESS: 1

To select a black background,

PRESS: 2

To specify some other shade for the background value,

PRESS: 3

In the latter case, the program will ask you to specify the gray shade you wish for your background:

TYPE BACKGROUND VALUE (0-255) ?

TYPE the desired value for the background (0 = Black, 255 = White), and

PRESS: RETURN

The program will now build the overlay file and set all pixels to the specified value. When the file has been built, the program will return to the Graphic Overlay Menu.

ADD A GRAPHIC TO AN OVERLAY

This program copies a graphic file into an overlay file. It will begin at the specified raster and pixel in the overlay file and copy as much of the indicated graphic file as will fit. The input graphic file is not altered.

To copy a graphic file into an overlay file, select option B on the Graphic Overlay Menu. The program will first ask:

TYPE DISK UNIT/OVERLAY FILE ID

TYPE the disk address at which the overlay file was stored, a slash (/), and the 8-character name of the overlay file, then

PRESS: RETURN

Next, the program will ask for the name of the graphic file to be copied:

TYPE DISK UNIT/GRAPHIC FILE ID

TYPE the disk address at which the desired graphic file was saved, a slash (/), and the 8-character name of the graphic file to be copied, then

PRESS: RETURN

The program will look for both requested files. If a file can not be found, the prompt will be repeated. You may type a new disk address and/or file ID, or you may type 'END/' in response to either prompt to return to the Graphic Overlay Menu.

If the files are found, the program will ask where you want to place the graphic file in the overlay:

TYPE LOCATION OF UPPER LEFT CORNER OF GRAPHIC

RASTER ?

PIXEL ?

TYPE the raster number in the overlay file which is to be the left edge of the graphic, and

PRESS: RETURN

Then,

TYPE the pixel position in the overlay file which is to be the top edge of the graphic, and

PRESS: RETURN

The program will now copy the graphic into the overlay file. Any data in the graphic file which will not fit in the overlay file will be ignored. When the graphic has been copied, the program will ask:

ANOTHER GRAPHIC FOR -------- (Y OR N) ?

To add another graphic file to the overlay,

PRESS: Y

To return to the Graphic Overlay Menu,

PRESS: N

CLEAR SPACE IN AN OVERLAY FILE

This option is intended to erase all or a part of the data in an overlay file. It may also be used to set any area in an overlay file to a specific background value. The area to be cleared will always be rectangular, bounded by selected pixels and rasters. Unique shapes can be handled by clearing more than one area.

To clear an area in an overlay, select option C on the Graphic Overlay Menu. The program will first ask for the name of the overlay file to be cleared:

TYPE DISK UNIT/OVERLAY FILE ID

TYPE the address of the disk on which the overlay file was stored, a slash (/), and the 8-character name of the overlay file to be cleared, then

PRESS: RETURN

Next, the program will ask which gray level is to be used for the cleared area:

SELECT CLEAR VALUE

1 - WHITE

2 - BLACK

3 - OTHER

To select a white background,

PRESS: 1

To select a black background,

PRESS: 2

To specify some other gray shade,

PRESS: 3

In the latter case the program will ask you to specify the gray level you want in the cleared area:

TYPE BACKGROUND VALUE (0 - 255) ?

TYPE the desired gray shade for the background of the cleared area (0 = Black, 255 = White), and

PRESS: RETURN

Finally, the program will ask you to indicte the boundary of the area to be cleared:

DEFINE AREA TO BE CLEARED

START - RASTER ?

- PIXEL ?

END - RASTER ?

- PIXEL ?

TYPE the number of the raster at the left edge of the area to be cleared, and

PRESS: RETURN

TYPE the number of the first (top) pixel in the raster to be cleared, and

PRESS: RETURN

TYPE the number of the raster at the right edge of the area to be cleared, and

PRESS: RETURN

TYPE the number of the last (bottom) pixel to be cleared, and

PRESS: RETURN

The program will now clear the area described above. When the area has been cleared, the program will return to the Graphic Overlay Menu.

SECTION VIII

ANALYZE GRAPHIC FILES

INTRODUCTION

Graphic file analysis provides an opportunity to review the basic structure and content of a graphic file. It may be used during enhancement to determine the best way to achieve a specific goal. It can also be used to determine the optimum slicing techniques.

The following analyses are available. You may count the number of pixels of a given intensity by raster or for the entire file. You may also display the relative intensity of the various pixels in a raster. In all cases, the program presents a bar graph of the selected values on the CONRAC display screen with supporting data on the WANG CRT.

The analysis program emulates the enhancement program in that it can convert the graphic data in the same way that the enhancement program does. The converted data is not saved during analysis, nor does the analysis program make an alteration to the input graphic file.

To analyze a graphic file, select option E on the Graphics Main Menu. The Analysis Menu is shown in figure 8-1.

GRAPHIC FILE ANALYSIS

SELECT OPTION BY PRESSING LETTER KEY

A - DISPLAY NUMBER OF PIXELS FOR EACH INTENSITY
(1 RASTER OR FILE)
B - DISPLAY INTENSITY OF PIXELS IN ONE RASTER

Z - ** Return to Main Menu **

Figure 8-1. Graphic Analysis Menu

ANALYZING A GRAPHIC FILE

Since both analysis programs function essentially the same way, the following discussion applies equally to both, except where indicated. Select the data you wish to display by pressing the appropriate letter key (A or B) on the Analysis Menu. Be sure to turn on and initialize the PGP and CONRAC units before running the analysis programs.

First the program will ask you which file you want to analyze:

SELECT INPUT DISK DEVICE

TYPE the address at which the input graphic file was last stored, and

PRESS: RETURN

SELECT INPUT FILE ID (8 CHARACTERS)

TYPE the name of the graphic file to be analyzed, and

PRESS: RETURN

If you select option A on the Analysis Menu, you may now elect to analyze the entire file at once or do a raster at a time:

PRESS F TO REVIEW FILE

R TO REVIEW RASTERS

If you want to do the whole file at once,

PRESS: F

If you want to view one raster at a time,

PRESS: R

Next, the programs will ask whether you want to emulate the enhancement program:

CONVERT FILE (Y OR N) ?

If you wish to emulate the enhancement program, then

PRESS: Y

If you want to look at the file as is,

PRESS: N

The following questions will only be asked if you requested enhancement program emulation above. First the number of pixel ranges:

HOW MANY RANGES (1 - 10) ?

TYPE the number of pixel ranges that you wish to convert, and

PRESS: RETURN

For each requested range the program will ask for the limits of the range, the mid-point of the range, and the enhancement factor. (See 'Enhancing a Graphic' in section V for a complete discussion of the enhancement parameters.)

LIST RANGES FROM LOWER TO UPPER

CURRENT RANGE IS -- TO --

LOWER LIMIT OF RANGE -- ?

UPPER LIMIT OF RANGE -- ?

MID-POINT (% OF RANGE) ?

ENHANCEMENT FACTOR (1-5)?

TYPE the lower limit of a range, and

PRESS: RETURN

TYPE the upper limit for the range, and

PRESS: RETURN

TYPE the mid-point of the range just entered as the percentage of the range to be on the lower end, and

PRESS: RETURN

TYPE the enhancement factor for the range, and

PRESS: RETURN

When the range data has been entered, the programs will ask if the converted pixel data is to be spread through the entire range of pixel values, or kept as is:

RANGE OPTION

O - ORIGINAL

E - EXPANDED

If you want to keep the original range of pixel values, then

PRESS: O

If you want to spread the converted pixels through the entire pixel range, then

PRESS: E

This ends the enhancement emulation option. The programs will now begin analyzing the input graphic.

When the programs have analyzed sufficient data for a display (either the entire file or one raster depending on your initial selections), a bar graph of the findings will be displayed on the CONRAC CRT screen. A summary of the data found will also be printed on the WANG CRT screen. A typical bar graph for a pixel count is

shown in figure 8-2; a graph for raster intensity is shown in figure 8-3. The following data will be shown on the WANG CRT:

--- RASTERS IN FILE; MAXIMUM VALUE ---

--- PIXELS PER RASTER; MINIMUM VALUE ---

TOTAL PIXELS ---; MIDPOINT IS ---

MAXIMUM VALUE DISPLAYED IS ---

RASTER --- NOW BEING DISPLAYED

NOTE: The 'maximum value displayed' refers to the bar graph on the CONRAC unit. To create the most reasonable display possible, the scale of the CONRAC display is automatically shifted from time to time. The value on the WANG CRT indicates the height of the tallest bar. The other bars are proportional to it.

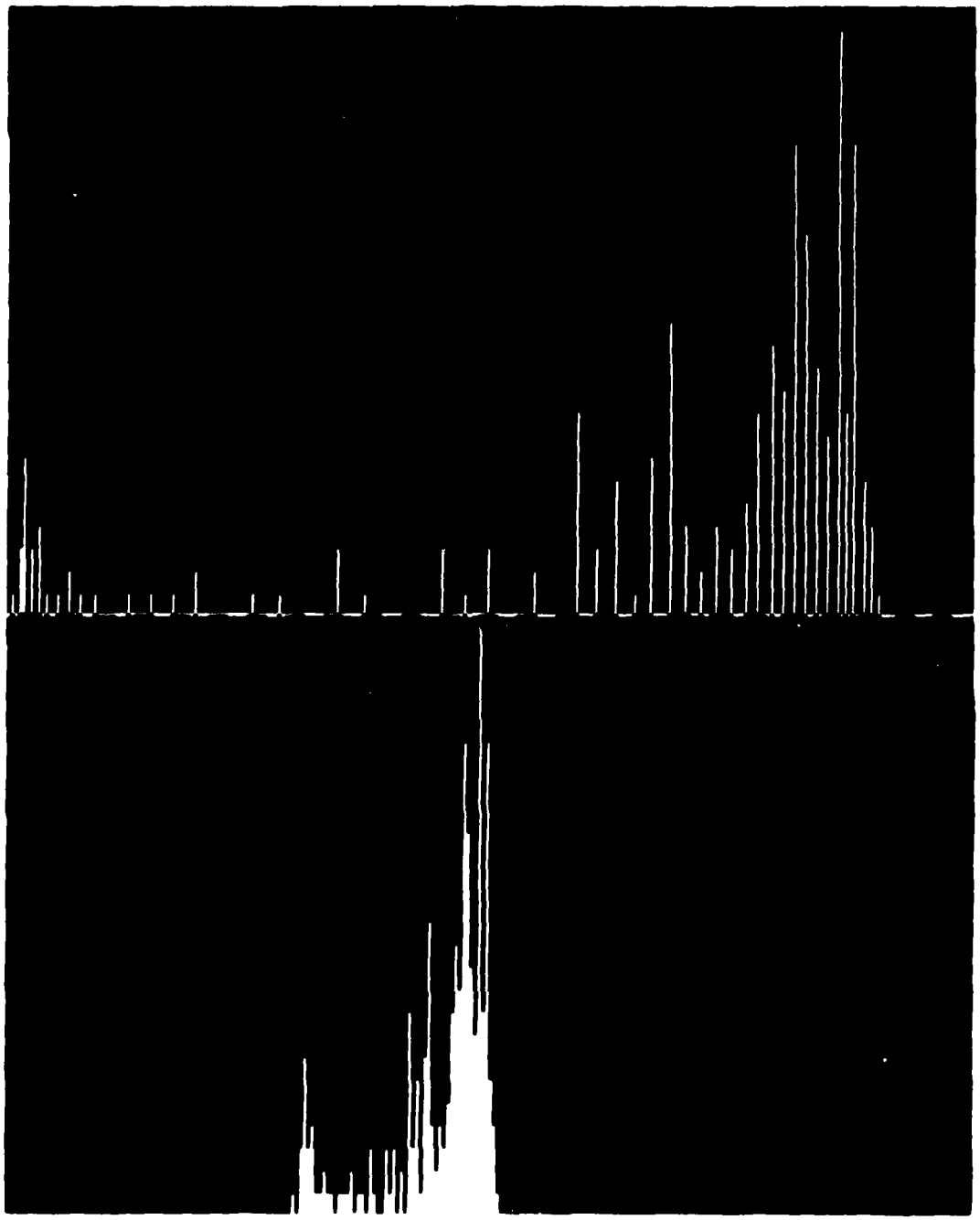


Figure 8-2. Pixel Count Display

Figure 8-1. Raster Intensity Display

The program provides the following options at this time:

PRESS P TO PRINT; C TO CONTINUE; E TO END

To continue with the next raster in the file,

PRESS: C

To terminate the program and return to the Analysis Menu,

PRESS: E

To print the values corresponding to the CONRAC display,

PRESS: P

In the latter case, the programs will ask you where you want to print the data:

WHICH OUTPUT DEVICE

TYPE the address of the output device on which you want to print the analysis data and,

PRESS: RETURN

The current analysis data will be printed and the program will return to the prior prompt and wait for further instructions.

SECTION IX

ARCHIVE SYSTEM

INTRODUCTION

Graphic data files and overlays are usually quite large. A single graphic file or overlay intended for use with typesetters can easily take up 2000 disk sectors. If 100 or so graphics are required for a single document, it would be impractical to retain all of these files, plus their intermediate files from enhancing and reducing, on-line all the time.

The archive system allows you to store off-line on tape graphic files which are not immediately required. Files stored on tape may be individually retrieved and can be rewritten onto the tape, if their overall size is not increased.

To load the archive system, select option F on the Graphics Main Menu. The Archive Menu is shown in figure 9-1.

ARCHIVE MENU

SELECT OPTION BY PRESSING LETTER KEY

A - INITIALIZE TAPE
B - SAVE A GRAPHIC FILE
C - RESTORE A GRAPHIC FILE
D - PRINT TAPE INDEX
E - DELETE INDEX ENTRY

Z - ** Return to Main Menu **

Figure 9-1. Archive Menu

INITIALIZING AN ARCHIVE TAPE

The archive tape has a special index file as its first file. This index must be built before a graphic file can be saved on the tape.

To initialize a tape, select option A on the Archive Menu. The program will ask you to mount a scratch tape (one that can be written on) with a write-ring inserted.

MOUNT SCRATCH TAPE WITH RING FOR OUTPUT

TYPE C TO CONTINUE; R TO RETRY; S TO STOP

Put the scratch tape on the tape drive, load the tape, and place the drive on-line. Be sure that a write-ring is in the tape. Then,

PRESS: C

Next, the program will ask for a name to identify this particular archive file. The archive system refers to each archive file as a 'PROJECT'. The 'PROJECT ID' is the name assigned to the archive file and is the way the programs in the archive system know that they have the correct tapes mounted.

TYPE GRAPHIC PROJECT ID

TYPE the 8-character project ID, and

PRESS: RETURN

The program will then ask about the density of the tape:

TAPE DENSITY (1 = 800, 2 = 1600) ?

If you are using an 800 BPI tape drive,

PRESS: 1

If you are using a 1600 BPI tape drive,

PRESS: 2

The program will install an empty index file on your tape, rewind it, and return to the Archive Menu.

SAVING A GRAPHIC FILE

Any graphic data file can be saved on tape. Annotation files can not be saved using the archive system.

To save a graphic data file on tape, select option B on the Archive Menu.

First the program will ask for the Project ID:

TYPE GRAPHIC PROJECT ID

TYPE the 8-character project ID that you used when creating the archive tape, and

PRESS: RETURN

The program will then ask for the first reel of the file:

MOUNT REEL 1 FOR PROJECT --------

TYPE C TO CONTINUE; R TO RETRY; S TO STOP

Mount the first reel for the indicated project, and

PRESS: C

If you typed the project ID incorrectly, you may try again:

PRESS: R

To terminate the program and return to the Archive Menu,

PRESS: S

The program will next ask what the tape density is:

TAPE DENSITY (1 = 800, 2 = 1600) ?

If you are using an 800 BPI tape,

PRESS: 1

If you are using a 1600 BPI tape,

PRESS: 2

The program will read the index from the tape and verify the project ID. The program will then ask for the name of the graphic file to be saved:

TYPE DISK UNIT/GRAPHIC FILE ID

TYPE the address of the disk unit on which the graphic file resides, a slash (/), and the 8-character name of the graphic file to be saved, then

PRESS: RETURN

If the graphic file is already listed in the tape index, the program will advise:

FILE ID FOUND IN TAPE INDEX

REPLACE FILE (Y OR N) ?

If you want to replace the original file,

PRESS: Y

NOTE: The new file must be the same length as the file on the tape. The program assumes that you know what you are doing if you ask it to replace a file.

If you do not want to replace the original file,

PRESS: N

In this case, the program will ask for a new graphic file ID. To terminate the program and return to the Archive Menu,

TYPE END

PRESS: RETURN

The program will determine which reel of a multi-reel file is required. If it is not already mounted, the program will advise:

PLEASE MOUNT REEL -- PROJECT -------- WITH RING

TYPE C TO CONTINUE; R TO RETRY; S TO STOP

Locate the correct reel, place a write-ring in it, and mount it on the tape drive. Then,

PRESS: C

The program will then begin copying the graphic file from disk to the tape. When it is finished, it will ask:

ADD ANOTHER FILE TO THIS PROJECT (Y OR N) ?

If you want to save another graphic file on the tape,

PRESS: Y

If you do not want to save another file on the tape,

PRESS: N

Before terminating, the program will re-write the index file on the beginning of reel one. If this reel is already mounted, the program will write the index, rewind the tape, and return to the Archive Menu. If reel one is not now mounted, the program will advise:

PLEASE REMOUNT REEL 1 WITH RING

TYPE C TO CONTINUE; R TO RETRY; S TO STOP

Mount the first reel of the project file w a write-ring installed, and

PRESS: C

The program will then re-write the index file and then terminate.

ERRORS. The following error messages may appear while saving a graphic on tape.

PROJECT ID INCORRECT

PLEASE MOUNT CORRECT REEL

TYPE C TO CONTINUE; R TO RETRY; S TO STOP

The wrong reel has been mounted. If you can locate the correct reel, mount it and

PRESS: R

If you can not find a suitable reel, you may terminate the program:

PRESS: S

If the following message appears:

REMOVE CURRENT REEL AND MOUNT

SCRATCH WITH RING FOR OUTPUT

PROJECT --------, REEL ----

TYPE C TO CONTINUE; R TO RETRY; S TO STOP

---

there is not enough room left on the current reel for the rest of the graphic file. Mount a new tape and add it to the project file. To continue the program after mounting a scratch tape,

PRESS: C

To terminate the program, if you can't find another scratch tape,

PRESS: S

RESTORING A GRAPHIC FILE

This program restores graphic files from a project tape to disk. To restore a graphic file from tape, select option C on the Archive Menu.

The program will ask for the project ID. This name will identify the correct tape file to the program.

TYPE GRAPHIC PROJECT ID

TYPE the 8-character project ID that you used when you created the tape file, and

PRESS: RETURN

The program will then wait until the correct tape has been mounted:

MOUNT REEL 1 FOR PROJECT --------

TYPE C TO CONTINUE; R TO RETRY; S TO STOP

Mount the first reel of the project file on the tape drive, turn the drive on, load the tape, and place the drive on-line. Then,

PRESS: C

The program will ask about the tape density:

TAPE DENSITY (1 = 800, 2 = 1600)

If you are using an 800 BPI tape, then

PRESS: 1

If you are using a 1600 BPI tape, then

PRESS: 2

The program will read the index file from the tape, verify the project name, and ask which file you want to restore:

TYPE GRAPHIC FILE ID

TYPE the 8-character graphic file ID you used when you saved the file, and

PRESS: RETURN

If the graphic file ID is found in the index, the program will determine which reel of the file the graphic is on. If it does not begin on the current reel, the program will ask:

PLEASE MOUNT REEL --- PROJECT --------

TYPE C TO CONTINUE; R TO RETRY; S TO STOP

Locate the correct tape reel, mount it on the tapedrive, and make it ready. Then,

PRESS: C

If you can not locate the required tape reel, you may terminate the program:

PRESS: S

When the correct reel has been mounted, the program will ask you where you want to restore the graphic file:

PUT FILE ON WHICH DISK UNIT ?

TYPE the address of the disk unit on which you want to place the graphic file, and

PRESS: RETURN

If the file does not already reside on the indicated disk, and if there is room for it, the program will copy the graphic file from the tape onto the disk and place the graphic file ID in the disk directory. After copying the file, the program will ask:

ANOTHER FILE FROM THIS PROJECT (Y OR N) ?

If you want to restore another graphic file from the same project,

PRESS: Y

If you want to terminate the program and return to the Archive Menu,

PRESS: N

ERRORS. The following error messages may appear while restoring a graphic file.

PROJECT ID INCORRECT

PLEASE MOUNT CORRECT REEL

TYPE C TO CONTINUE; R TO RETRY; S TO STOP

The wrong reel has been mounted. If you can locate the correct reel, mount it and

PRESS: R

If you can not find a suitable reel, you may terminate the program:

PRESS: S

If the following message appears:

REMOVE CURRENT REEL AND MOUNT

REEL ---, PROJECT --------

TYPE C TO CONTINUE; R TO RETRY; S TO STOP

---

the graphic file is continued on the next reel of the project file To continue the program after mounting the next reel of the file,

PRESS: C

To terminate the program, if you can not find the correct reel,

PRESS: S

If the following message appears:

DISK DEVICE NOT AVAILABLE

---

the program can not access the disk device you requested. You may request a different disk device or type 'END/' to terminate the program and return to the Archive Menu.

If the following message appears:

FILE EXISTS ON DISK - SCRATCH (Y OR N) ?

---

a file with the same name as the one you requested for your graphic file already exists on the indicated disk. If you wish to write over the existing file (assuming it is large enough to hold your graphic), destroying its contents, then

PRESS: Y

If you wish to save the existing file, then

PRESS: N

PRINT THE TAPE INDEX

You can review the contents of a project tape file by printing the index file. The index contains the names of the graphic files stored on the project tape(s) and their location within the file. The index may be listed on a line printer or on the WANG CRT screen.

To list an index, select option D on the Archive Menu. The program will first ask for the project ID:

TYPE GRAPHIC PROJECT ID

TYPE the 8-character project ID that was used when the tape file was created, then

PRESS: RETURN

The program will then wait for the first reel of the project file to be mounted:

MOUNT REEL 1 FOR PROJECT --------

TYPE C TO CONTINUE; R TO RETRY; S TO STOP

Mount the first reel of the indicated project on the tape drive, turn the drive on, load the tape, and place it on-line. Then,

PRESS: C

The program will then ask about the tape density:

TAPE DENSITY (1 = 800, 2 = 1600) ?

If you are using an 800 BPI tape,

PRESS: 1

If you are using a 1600 BPI tape,

PRESS: 2

The program will read the index file and verify the project ID. Then the program will ask where you want to list the index:

SELECT OUTPUT DEVICE

TYPE the address of the device on which you want to list the index, and

PRESS: RETURN

The program will then list the index and return to the Archive Menu. If you requested output on the WANG CRT, the program will provide routine paging options.

ERRORS. The following error messages may appear while listing an index.

PROJECT ID INCORRECT

PLEASE MOUNT CORRECT REEL

TYPE C TO CONTINUE; R TO RETRY; S TO STOP

To mount the correct reel

PRESS: R

To terminate the program and return to the Archive Menu

PRESS: S

DELETE AN ENTRY FROM INDEX

Graphic files can not be removed or deleted from a project file tape. The project index is fixed in size and can not be expanded. To add additional graphic files to a full project file, this program allows you to remove entries from the project index. The file whose entry is deleted from the index is still present on the tape, but can no longer be accessed. A new graphic file may be added to the project file and its name placed in the index in place of the deleted file name.

To delete an entry from the index, select option E on the Archive Menu. The program will first ask for the project ID:

TYPE GRAPHIC PROJECT ID

TYPE the 8-character project ID that you used when creating the project file, and

PRESS: RETURN

Next the program will ask for the first reel of the project file:

MOUNT REEL 1 FOR PROJECT --------

TYPE C TO CONTINUE; R TO RETRY; S TO STOP

Mount the first reel of the project file, turn on the tape drive, load the tape, and place the tape on-line. Then,

PRESS: C

The program will ask about tape density:

TAPE DENSITY (1 = 800, 2 = 1600) ?

If you are using an 800 BPI tape,

PRESS: 1

If you are using a 1600 BPI tape,

PRESS: 2

The program will read the index file and verify the project ID. Then the program will ask:

TYPE FILE ID TO BE DELETED

TYPE the 8-character name of the graphic file to be deleted from the index, and

PRESS: RETURN

If the name is found in the index, the program will ask:

REALLY DELETE -------- ?

To verify that you want to delete this file,

PRESS: Y

If you do not want to delete the file name displayed,

PRESS: N

The program will take the appropriate action and then it will ask:

MORE FILES TO DELETE (Y OR N) ?

If you want to delete more files,

PRESS: Y

If you are through,

PRESS: N

If you opt to continue, the program will ask:

SAME PROJECT (Y OR N) ?

If you want to delete more entries from the current project,

PRESS: Y

If you now want a different project file,

PRESS: N

ERRORS. The following error messages may appear while deleting index entries:

PROJECT ID INCORRECT

PLEASE MOUNT CORRECT REEL

TYPE C TO CONTINUE; R TO RETRY; S TO STOP

To mount the correct reel

PRESS: R

To terminate the program and return to the Archive Menu

PRESS: S

If the following message appears:

REQUESTED FILE NOT FOUND IN INDEX

TYPE C TO CONTINUE; R TO RETRY; S TO STOP

---

the graphic file name is not in the index. To try another graphic file ID,

PRESS: C

To try another tape,

PRESS: R

To terminate the program,

PRESS: S

NOTE: The program must write the index back on the tape when you are through deleting entries. When using more than 1 project file, it is safer to leave the current project tape mounted until the program asks for a new project tape. If you try to get ahead of the program, it could write over the wrong index and destroy it.

APPENDIX A

EQUIPMENT DESCRIPTIONS

VIDEO CAMERA

The Hamamatsu C-1000 video camera was used by TAEG to develop the Graphic Processing System. A COSMICAR 25mm f/1.9 Television Camera Lens and a MICRO-NIKKOR 55mm f/3.5 lens with a SOLIGOR T-2 mount were used with the camera.

The video camera is connected to the WANG Central Processing Unit (CPU) through a WANG 2254 interface. The camera was ordered with a M999-04 General Purpose Interface Bus (GPIB) and an M1004 video analog-to-digital converter.

The M999-04 GPIB interface conforms to IEEE Standard 488-1975. The microprocessor in the M999-04 controls all camera operations and handles all GPIB communications. The interface allows the camera to be operated in a system with a compatible bus controller and up to 13 other instruments. The extended listener function allows remote programming of the camera setup parameters, and the talker function enables the acquisition of video data. System programming is simplified by the service request function which may interrupt the controller when data is available and responds to a serial poll.

The C-1000 camera has a square field of view which is considered to be a matrix of 1024 by 1024 pixels. When commanded to take data, the interface gathers data along a vertical line from the top of the field of view to the bottom. The horizontal position of the line is called the x-coordinate. The left edge of the field of view is x-coordinate 0, the right edge is x-coordinate 1023, and the default position is 512 (mid-field). The current x-coordinate during a scan is indicated by a white marker, or "sample line", on the monitor.

The C-1000 camera employs a raster scan which scans the entire field of view with 256 horizontal lines every 16.7 milliseconds (ms). An interlacing technique causes the camera to shift its scanning raster slightly on subsequent fields in order to sample areas between the scan lines. In this way vertical resolutions of up to 1024 may be obtained at the expense of longer data acquisition times. A 2:1 interlace causes alternate scans to be offset midway between each other to achieve 512 vertical resolution in 33.3 ms. A 4:1 interlace results in four sequential scans to be slightly offset to achieve 1024 resolution in 66.7 ms.

Four horizontal resolutions are possible: 1024, 512, 256 and 128. If a horizontal resolution is not specified, it will be the same as the vertical resolution.

Video data consists of 8-bit intensity values for each point along a vertical line at the current x-coordinate. The points are transmitted from the top of the field of view to the bottom. Each point may have an intensity from 0 to 255, with 0 being darkest and 255 most white. The camera and interface are fully described in Hamamatsu publication no. 151-206-00, "M-99904 General Purpose Interface Bus (GPIB)," October 1977. It may be ordered from Hamamatsu Systems Inc., 332 Second Ave, Waltham, MA 02154.

CAMERA MONITOR

A small Sony television set, the Sony CMV-115 video monitor, is used to display the operation of the Hamamatsu camera. The monitor has a 10-inch black and white screen and has been modified to operate directly connected to a video camera.

GRAPHIC DISPLAY SYSTEM

The Genisco series GCT-3000 graphic display system is used by TAEG. This system interfaces with the WANG CPU and generates the display of digitized graphic data. The system includes the following elements:

PROGRAMMABLE GRAPHIC PROCESSOR (PGP) (GCT-3011). The PGP is a fully programmable microprocessor, capable of storing and executing its own programs. It is used as the controller of the graphic display system. It loads the video lookup table (VLT), reads graphic data and instructions from the WANG CPU, stores and modifies the graphic data, and performs all communications with the video control unit and display monitor. It includes a 256 by 16 Random Access Memory (RAM) and an arithmetic logic unit for mathematical manipulations.

CUSTOM I/O INTERFACE. This custom interface connects the Genisco Programmable Graphics Processor (PGP) to the WANG 2200 series miniprocessors: the PGP was designed to work with the NOVA processors. Therefore, the custom interface causes the PGP to accept WANG data as though it were coming from a NOVA computer, and converts the PGP's data into a format the WANG computer can understand.

VIDEO CONTROL UNIT (GCT-3031). The video control unit generates the timing signals for graphic memory planes and the synchronizing signals for the graphic display monitor. The video control unit also allows the PGP to write data into the memory plane without affecting the monitor refresh cycle. It contains 4K buffer memory which can also be used by the PGP for additional program storage.

MONITOR CONTROL UNIT (GCT-3032). The monitor control unit contains the logic for processing video data and cursor commands for the graphic display monitor. It receives serial data from four refresh memory planes and passes the data through video gates in accordance with the current latch setting provided by the PGP. The video lookup table is addressed by the data from the memory refresh planes. The addressed data in the VLT is read out in 3 four-bit groups. The high order 8 bits are sent to the video mixer for a black and white monitor. The video mixer output is sent to digital-to-analog converters and then to the display monitor.

GRAPHIC DISPLAY MONITOR. Output from the PGP is displayed on a CONRAC Model ROB-17C black and white CRT. The CRT screen is capable of displaying a 640 by 512 pixel matrix with 16 shades of gray. When turned on its side, the CRT screen emulates an 8 1/2 by 11 inch page.

The CONRAC unit provides the capability to modify the size and shape of the display and to display two different versions of the same image at the flip of a switch. The image may also be reversed in shade. The CONRAC unit is connected to a Tektronix model 4634 printer which can provide a copy of the displayed image on dry silver paper.

APPENDIX B

FILE NAMING CONVENTIONS

The Graphic Processing System uses certain file naming conventions to indicate a relationship among the various files generated by the system from a single original graphic.

The first file name to be assigned to any graphic file is that given to the file when it is scanned or sliced. This name consists of a four character graphic identifier supplied by the user, and a four character suffix provided by the program. The suffix has a specific format and serves to identify the resolution at which the graphic was scanned. The possible suffixes are listed below:

RESOLUTION	SUFFIX
256	.256
512	.512
1024	.024

For example, if the graphic ID is ABCD and the graphic is scanned at a resolution of 256, the system would assign the graphic file ID of ABCD.256

Various enhancement programs will alter the suffix of the graphic file ID to indicate that the output file has been operated on by a particular program. This alteration will take place on any input file ID, not just those assigned by the system. For this reason, it is best not to assign unique graphic file ID's which contain one of the system assigned characters in a critical position in the file ID (position 6 and 7).

The enhancement programs assign file names according to the following scheme:

The scaling program will change the sixth character of the file name to an 'S.' For example: if the input file was ABCD.256, the output file would be ABCD.S56.

The reducing program will change the seventh character of the input file name to an 'R.' For example: if the input file was ABCD.256, then the output file would be ABCD.2R6.

The enlarging program will change the seventh character of the input file name to an 'E.' For example: if the input file were ABCD.256, then the output file would be ABCD.2E6.

The edge trimming program will change the seventh character of the input file name to a 'T.' For example: if the input file name were ABCD.256, then the output file would be ABCD.2T6.

The compressing program will change the sixth character of the input file name to a 'C.' For example: if the input file name were ABCD.256, then the output file name would be ABCD.C56.

The enhancement program will change the sixth character of the file name to an 'L.' For example: if the input file name were ABCD.256, then the output file name would be ABCD.L56

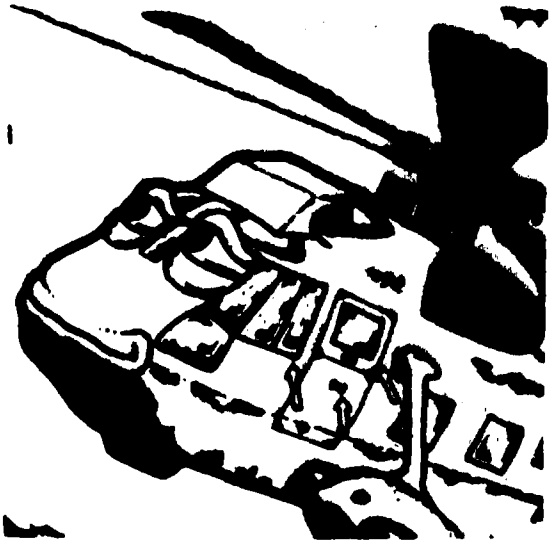
A system assigned graphic file ID may reflect processing by more than one program. The last character in the name will still serve to specify the original scan resolution. For example:

ABCD.SR2	Scaled Reduced Scanned at 512
ABCD.LT4	Enhanced Trimmed Scanned at 1024
ABCD.CE6	Compressed Enlarged Scanned at 256

APPENDIX C

SLICING EXAMPLES

The following pages contain several examples of slicing line drawings. In each case, the image in the upper left corner is the line drawing scanned normally. The remaining images are the same drawing sliced with the indicated separation values.



A Original

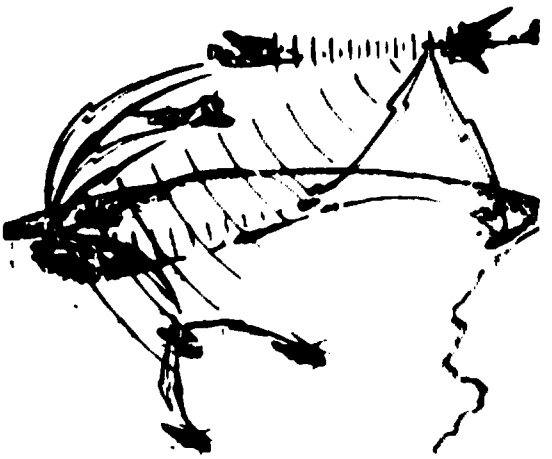
B. Sliced
(Separation = 80)

Figure C-1. Dark Detailed Line Drawing

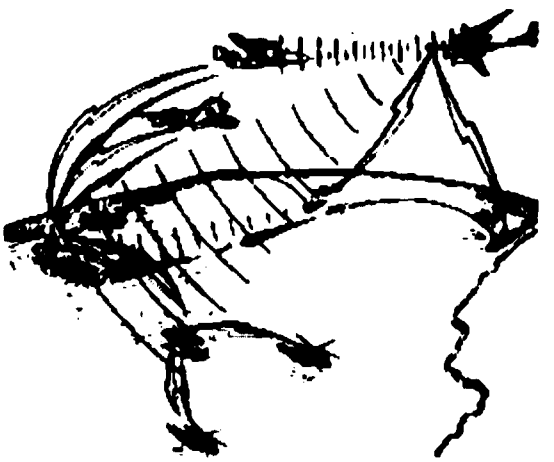
A Original

B Sliced
(Separation = 42)

Figure C-2. Light Detailed Line Drawing



A Original



B Sliced
(Separation = 6mm)

Figure C-3. Average Line Drawing

APPENDIX D

FILE DESCRIPTIONS

GRAPHIC DATA FILE

The graphic data file consists of a one-sector header record followed by as many sectors as necessary to contain the digitized graphic data. Two spare sectors are appended to the file for standard system trailer records.

The header record contains all data necessary to describe the file contents. The data records contain data only, there are no format or control characters. Data is stored according to the following conditions:

- By raster in raster order from left to right.
- If a raster contains 128 pixels or less, two rasters are stored per sector. The first raster begins at position 1; the second raster begins at position 129.
- If a raster contains more than 128 pixels, it will be stored in one or more contiguous sectors. Each data record will begin at position 1 of the sector. Unused positions in a sector will contain unspecified data.

For example:

Raster Length	# Sectors/Raster
1-128	1/2
129-256	1
257-512	2
513-768	3
769-1024	4
]1024	5 or more

The file size is determined by multiplying the number of rasters by the integer obtained by dividing the number of pixels per raster plus 255 by 256, and adding three:

$$\text{INT}\left(\frac{(\text{pixels} + 255)}{256}\right) \times \text{No. Rasters} + 3$$

The format for the graphic file header record is shown in figure D-1. Also shown is a sample graphic file header record.

POSITION	VARIABLE	DATA
1-8	F1$	Graphic File ID
9	H$	Maximum Pixel Value
10	L$	Lowest Pixel Value
11-12	N	No. Sectors if File
13-14	N1	No. of Rasters
14-16	N2	No. Pixels/Raster
17	N6	File Type: HEX(10)=8 bits/pixel HEX(0C)=4 bits/pixel HEX(04)=4 bits/pixel, compressed HEX(00)=8 bits/pixel, compressed
18		Horizontal Scale HEX(01)=256 HEX(02)=512 HEX(04)=1024
19		Vertical Scale HEX(01)=128 HEX(02)=256 HEX(03)=512 HEX(04)=1024
20-256		Not Used

Figure D-1. Graphic Data File Header Record
(Page 1 of 2 - Record Layout)

```
DISK UNIT: 820


RECORD 709
473030322E45353690 1F008300CD005D0C0000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000

 G 0 0 2 . E 5 6 . . .  . . . ] . . . . . .
 . . . . . .
 . . . . . .
 . . . . . .
 . . . . . .
 . . . . . .
 . . . . . .
```

Figure D-1. Graphic Data File Header Record
(Page 2 of 2 - Record Dump)

ANNOTATION FILE

The annotation file consists of three disk sectors. No provision is made for standard trailers. Position 1-8 in the first sector contains the name of the graphic file which is being annotated. The remainder of the file consists of annotation records. The end of the annotation file is indicated by a hex FF value in the first position of an annotation record. The format for annotation records is shown in figure D-2. A sample annotation file is shown in figure D-3.

Annotation File Format

Bytes 1-8 Name of Annotated File/Graphic/Page
Bytes 9-768 Annotation Records

	Byte							
Function	1	2 (1)	3-4	5-6	7-8	9-10	11-12	13-14
Line	L	Dash Neg Width	Start IX	Point IY	End EX	Point EY	Not	Used
Rect.	R	Dash Neg Width Fill	Start IX	Diag. IY	End EX	Diag. EY	Not	Used
Circle	O	Neg Width	Center IX	Point IY	Edge EX	Point EY	Not	Used
Arrowhd	A	Neg Width	Apex XO	Point YO	Vector EX	End EY	Vector EX	End EY
Text	T	Neg	Start IX	Text IY	Font ID	Length of txt	Rot Cd (2)	Text ->
Arc	C	Neg Width	Center IX	Point IY	A-head XO	Apex YO	Dir (3)	Siz (4) Not Used
Dart	V	Neg	Dart IX	Point IY	Dart EX	End EY	Drt Typ (5)	Not Used
Point	Y	Neg	Point IX	Locus IY	Point ID			

NOTES:

1. Status Codes (Byte 2)
   Width (Bits 0-2)
   000 = 1 Line 100 = 5 Lines
   001 = 2 Lines 101 = 6 Lines
   010 = 3 Lines 110 = 7 Lines
   011 = 4 Lines 111 = 8 Lines

   Attribute (Bits 3-7)
   Dash = hex 08
   Fill = hex 02
   Neg = hex 01

2. Rotation Code (Byte 11)
   Hex 81

3. Direction of Arc (Byte 11)
   Right = hex 01
   Left = hex 02

4. Size of Arc (Byte 12)
   Number of 45-degree Segments in hex. Hex 00-08.

5. Dart Type (Byte 11)
   Hex 01 = Vertical Base
   Hex 02 = Horizontal Base

6. File Terminator (Byte 1)
   Hex FF

Figure D-2. Annotation Record Formats

DISK/FILE ID: 820/ ANNOTATES: G002.E56

5401026F004C0000000381545241434E434E47

5401026F01960000000003813434

4C01026001DA02600038

5401025D00680000002E81537465702031333A202041646A7573742068 6F72697A6F6E74616C2070 6F736974696F6E206F66207472616365

5401023F00AE0000002881507572706F73653A2020546F20706F736974696F6E207468652062656 7696E6E696E67206F6620746865

4C01023500AE023500E3

5401023100F50000001D817472616365206174206C6566742065646765206F66207363616C652E

5401020B00680000000078141637469 6F6E

4C0101FF006801FF0096

5401014300680000003C81526573706F6E73652020202020202020202020202020202020202020202020 2020202030202020202020202020202020202020202020202020202020202020202020

4C01013700680137 00A6

Figure D-3. Sample Annotation File
(Page 1 of 2 - File Listing)

```
DISK UNIT: 820


RECORD 703
473030322E45353654010260F004C000000098154524149 4E494E4754010 2CF01960000000381 3434
4C0102600 1DA0260003B5401025D0068000000 2E8153746570203133 3A202041646A7573742068 6F
72697A6F6E74616C20706F736974696F6E206F662074726163655401023F00AE000000288150757 2
706F73653A2020546F20706F736974696F6E2074686520626567696E6E696E67206F662074686 54C
01023500AE023500E3540102310 0F50000001D8174726163652061742 06C6566742065646765206F
662073636 16C652E5401020800680000000781416374696F6E4C0101FF006801FF00365401014300
680000003C81526573706F6E73652020


 G O O 2 . E 5 6 T . . o . L . . . . T R A I N I N G T . . o . . . . . 4 4
 L . . ' . . . ' . ; T . . J . h . . . . S t e p 1 3 : A d j u s t h o
 r i z o n t a l p o s i t i o n o f t r a c e T . . ? . . . . . + P u r
 p o s e : . T o p o s i t i o n t h e b e g i n n i n g o f t h e L
 . . S . . . S . . T . . 1 . . . . . t r a c e a t l e f t e d g e o
 f s c a l e . T . . . . h . . . . A c t i o n L . . . . h . . . . T . . C .
 h . . . < R e s p o n s e


RECORD 704
2020202020202020202020202020202020202020202020202020202020202020202020202020202020
2020202020202020204C0101370068013700A6FF0000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000


                L . . 7 . h . 7 . . . . . .
 . . . . . .
 . . . . . .
 . . . . . .
 . . . . . .
 . . . . . .
```

Figure D-3. Sample Annotation File
(Page 2 of 2 - File Dump)

ARCHIVE FILE INDEX

The Archive File Index consists of 400 10-character entries. The entries are maintained in ascending order. Blank or unused entries contain all hex FF characters. The format for an entry is:

POSITION	CONTENT
1-8	Graphic File Name
9-10	File Location
	bits 1-4 Reel Number
	bits 5-16 File number within reel

APPENDIX E

ENHANCEMENT EXAMPLES

The following pages exhibit the results of various enhancement techniques on the same original graphic file. The graphic was scanned with a resolution of 256. In all cases, the enhancement was done on the original graphic file.

Figure E-1. Scan at 256 Resolution

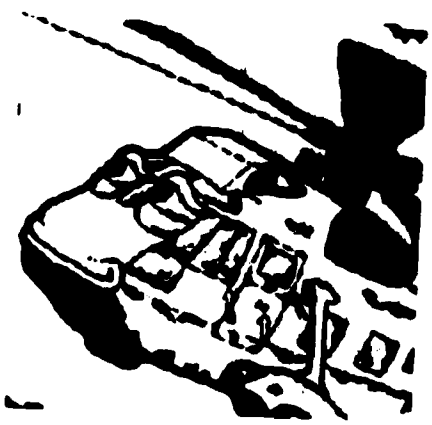


Figure E-2. 25 Percent Reduction

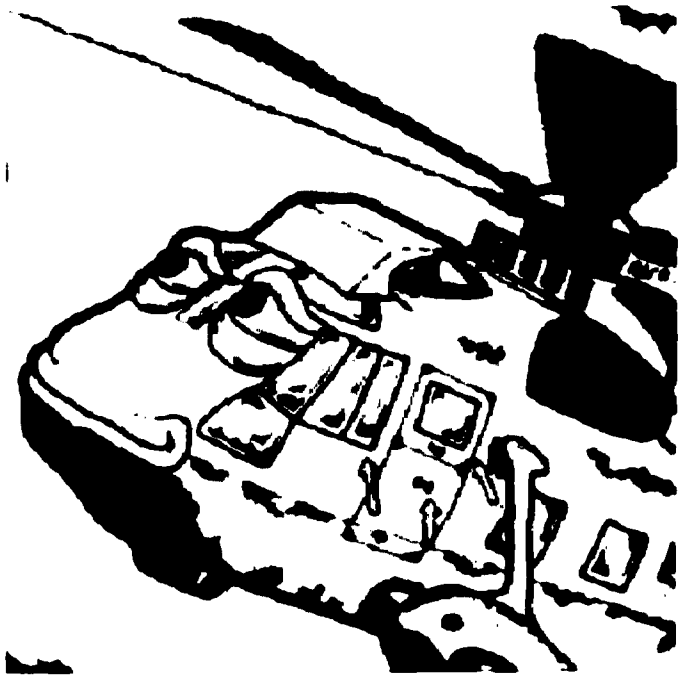
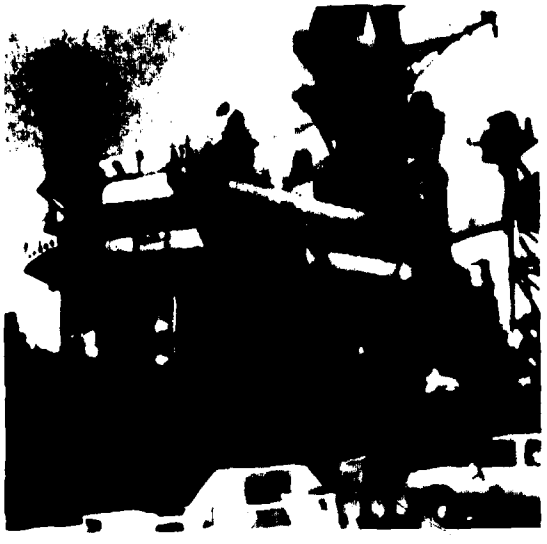


Figure E-3. 25 Percent Enlargement

A Original

B Enhancement
(Mid-point = 25%)
(Enhancement = 3)

Figure E-4. Grayscale Enhancement Example



A Original Graphic
(Enhanced)

B Edges Enhanced
(Horiz. & Vert.)

Figure E-5. Edge Enhancement - Horiz. & Vert.

Figure E-6. Posterization Sample

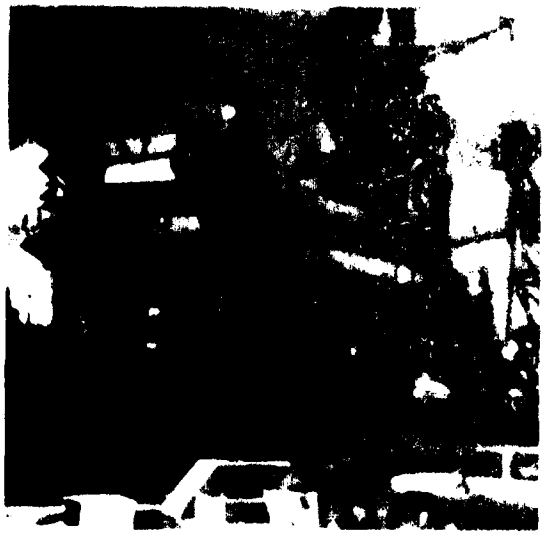


Figure E-7. Solarization Sample

APPENDIX F

PGP MEMORY GATING

The standard video-lookup table (VLT) consists of 256 12-bit words (see figure F-1).

Associated with the VLT are eight video gating latches whose outputs gate memory data to the VLT address register. If the latch for a memory plane is not set, the data for that memory plane is inhibited from addressing the VLT.

If a system, such as the one used at TAEG, only has four memory planes, it can address only 16 locations at any one time. The 16 locations that are addressed can be anywhere in the 256-word VLT, since unused memory data lines are forced true and any video gating latch may be turned on. A new group of 16 VLT locations is thus addressable by the four existing memory planes each time a new bit combination of the four high-order video gating latches is enabled.

When transmitting graphic data to the PGP, the raster represents the Y direction, the pixel position the X direction and the pixel value the Z direction. The pixel value is placed in the memory planes at the location defined by the raster and pixel positions. The number of memory planes involved depends on the total available planes and the number and position of planes selected for use.

The number and position of memory planes selected depends on the value entered in response to the SELECT MEMORY PLANES query. The value entered is converted to a four-digit binary number. The position of the 1-bits in the number determine the memory planes to be used. See figure F-2 for examples.

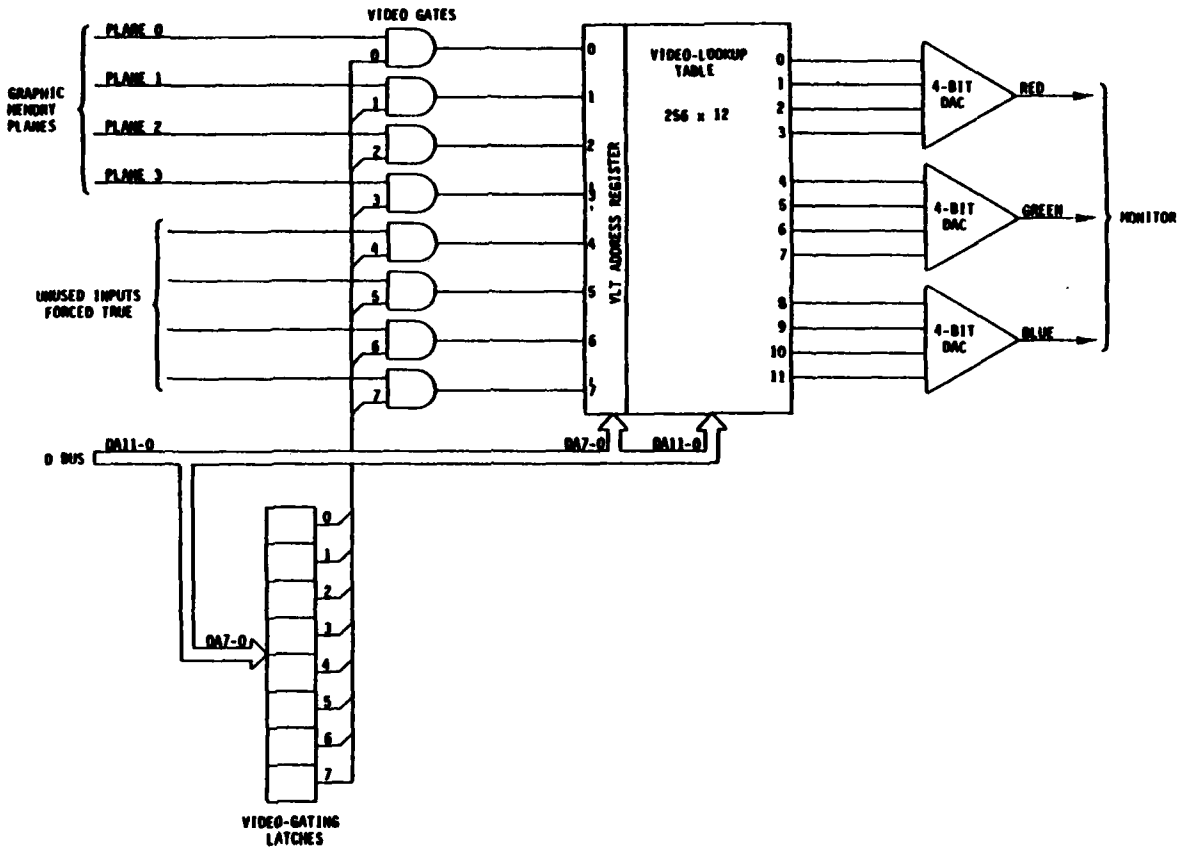


Figure F-1. Video Gating Diagram

VALUE	BINARY	MEMORY PLANES
0	0000	None
1	0001	1
2	0010	2
3	0011	1,2
4	0100	3
5	0101	1
6	0110	2,3
7	0111	1,2,3
8	1000	4
9	1001	1
10	1010	2
11	1011	1,2
12	1100	3,4
13	1101	1
14	1110	2,3,4
15	1111	1,2,3,4

Figure F-2. Memory Plane Selection

Gate latches are selected in the same manner as memory planes. The bit pattern for the number entered in response to the SELECT GATE LATCHES query will determine which latches are enabled.

Graphic data is transmitted to the PGP with four pixels in each 16-bit word. Each pixel is examined and the bit data stored in the respective memory plane at the appropriate coordinates. The rightmost bit of each pixel is stored in memory plane 1; the leftmost bit in memory plane 4.

APPENDIX G

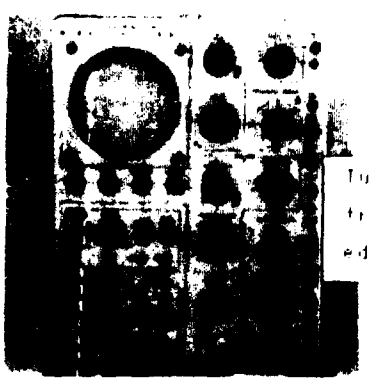
ANNOTATION SAMPLES

Figure G-1 shows an overlay of three graphics with annotations. The annotation file for this page is listed in figure G-2. A dump of the disk sectors of the annotation file is shown in figure G-3.

Step 1 Adjust horizontal position of trace

Purpose To position the beginning of the trace at left edge of scale

Action



Turn knob until trace touches left edge of the scale

Response

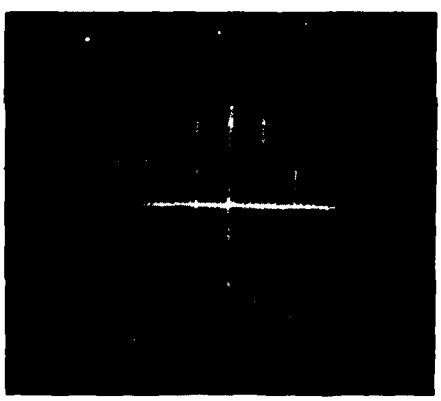


Figure G-1. Sample Graphic Overlay with Annotations

```
DISK/FILE ID: B20/      ANNOTATES: G002.E56

4C0101AB01A30173009E
41110173009E017000A9017C00A6
4C0801CB005B00D40050
411800D4005000DF005600DF004A
520201B100C801750154
540101AA00D0000000010815475726E20686E6F6220756E74696C
5401019800D000000001381747261636520746F7563686573206C656674
5401018600D000000001381656467652O6F662074686520736361C652E
520101B100C801750154
```

Figure G-2. Annotation File Listing

```
DISK UNIT: 820


RECORD 706
4730303228E4535364C0101AB01A30173009E41110173009E017000A3017C00AE4C0801CB005B0004
00504118000400500000F005600DF004A520201B100CB017501545401014A00D0000000010B1547572
6E206B6E6F6220756E74696C5401019800D0000000138174726163652074 6F7563686573206C0566
7454010186000D0000000138165646765206F662074686520736361 6C652E520101B100C801750154
FF0000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000


 G O O 2 . E 5 6 L . . . . . s . . A . . s . . . p . . . i . . L . . . . f . .
 . P A . . . . P . . . V . . . J R . . . . . u . T T . . . . . T u r
 n  k n o b  u n t i l T . . . . . t r a c e  t o u c h e s  l e f
 t T . . . . . e d g e  o f  t h e  s c a l e . R . . . . . u . T
 . . . . . .
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 . . . . . .


RECORD 707
0000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000


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```

Figure G-3. Annotation File Dump

TAEG Report No. 107

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